(3) Container Yard Planning and Container Cargo Handling Equipment

1) Layout Plan of Container Terminal

Planned layout of the new container terminal at North Kalibaru phase I is shown in Figure 5.1.2-10 and Figure 5.1.2-11, which consists of construction of 1,200m length of quays, 12 quay cranes and 8,208 ground slots.

The concept of terminal layout is to be used in terms of 2 berths (300m*2) by one terminal operator. This berth arrangement is expected to use small/medium size to Post-Panamax type integrally. The space in the back is 600m including the space of the road and bank in addition to 550m in depth of the yard.

2) Design Condition for Required Cargo handling Equipment

Design condition of handling capacity by 1 berth is calculated and shown in Table 5.1.2-13. This capacity is calculated as 480,000 TEUs from total 1.9 million TEUs and corresponding number of berths and necessary cargo handling equipment are worked out and shown in Table 5.1.2-14

Table 5.1.2-13 Design Condition of Handling Capacity by 1 berth (300m)

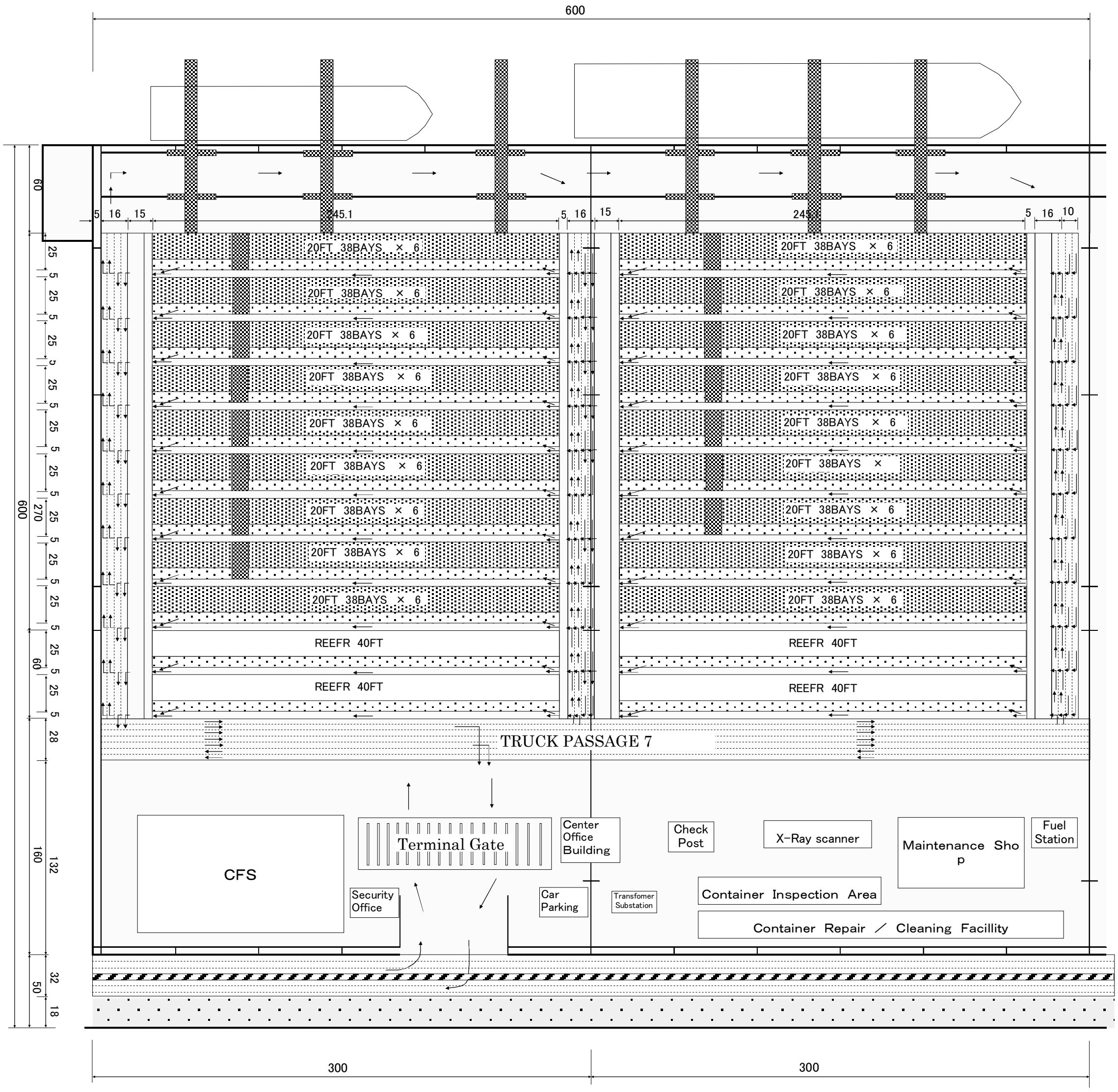
Capacity (TEUs/Year・berth)	480,000
Av. Days of Stock	3.3
Stacking efficiency	0.75
Peak ratio	1.3
Feeder ratio	0.02
Yard Capacity(TEUs)	7,375
Tier	4
Calculated Ground slots(TEUs)	1,844

Source: JICA Study Team

Table 5.1.2-14 Cargo handling equipment per 1 terminal (600m)

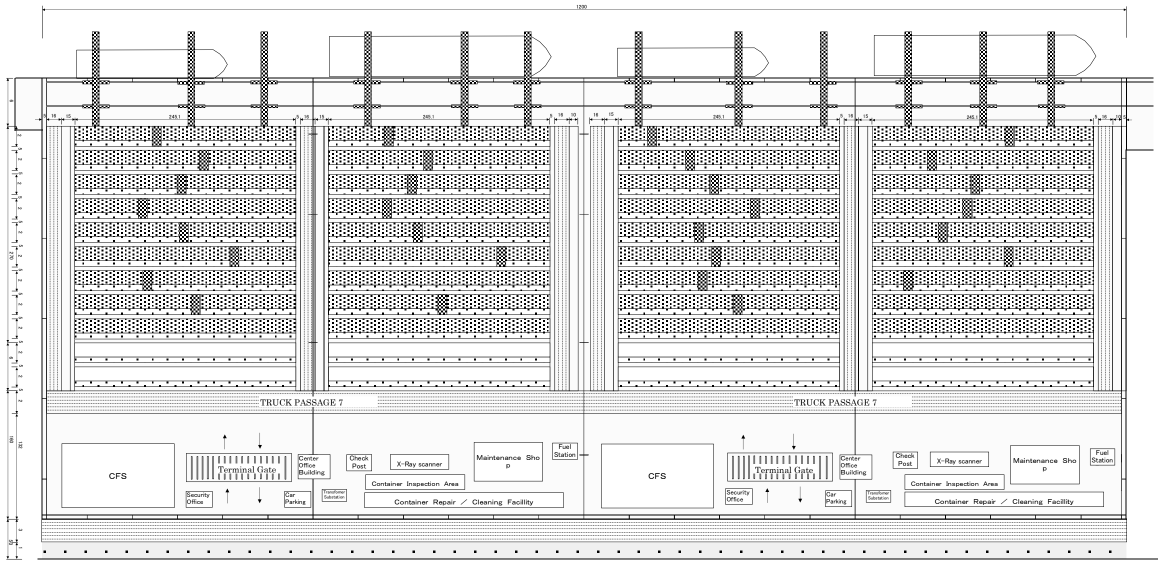
QGC	6
Yard tractor	36
Yard chassis	38
RTG	15
Top lifter	3
Forklift 5t	6
Forklift 10t	6

Source: JICA Study Team



Source: JICA Study Team

Figure 5.1.2-10 Container yard layout plan (300m:*2berth) at North Kalibaru



Source: JICA Study Team

Figure 5.1.2-11 Terminal Layout (Phase 1) at North Kalibaru

3) Long term Planned Cargo Handling Equipment of Phased Development of Terminal Area

Proposed container yard and required cargo handling equipment of new container terminal at North Kalibaru for phase 2 and 3 stages are worked out and listed in Table 5.1.2-15 based on the similar concept of the Phase 1 for estimating required cargo handling equipment.

Table 5.1.2-15 Long Term Planned Type and Quantity of Cargo Handling Equipment

	Phase Ⅰ	Phase Ⅱ	Phase Ⅲ	Total
Berth Length (m)	1,200	2,000	2,600	5,800
Depth	(-15.5m)	(-15.5m)	(-15.5m)	
Capacity(million TEUs)	1.9	3.2	4.3	9.4
Ground Slot(TEUs)	7,376	12,292	15,980	35,648
QCG No.	12	18	24	54
Yard tractor	72	108	144	324
Yard chassis	76	114	152	342
RTG	30	45	60	135
Top lifter	6	9	12	27
Forklift 5t	12	18	24	54
Forklift 10t	12	18	24	54

Source: JICA Study Team

(4) Yard Development by Reclamation

1) Design of Revetment of Container yard by Recycling existing material

New Breakwater (New Dam Tengah) by Recycled Material of Existing Breakwaters

Under URPT the existing breakwater ("Dam Tengah") is planned to be relocated for widening the existing inner port channel for 740 m to provide the required area for turning basin in front of the existing container terminals.

A new sea wall for development of the container yard will be constructed off-shore behind the reclamation yard which will be around 940 m away from the existing breakwater (Dam Tengah and Citra).

Table 5.1.2-16 Distance of a New Revetment from the Existing Breakwater

1. The required distance between the existing berths of JICT/KOJA and new off shore berths	740 m
1.1 Berthing area on both side of basin 50 m x 2	100 m
1.2 Diameter of turning basin	640 m
2. Planned container yard width	600 m
3. Distance of the existing breakwater from berths of JICT and KOJA	- 400 m
4. Distance from the existing breakwater to a new location	940 m

Source: JICA Study Team

However a new breakwater is required between the end point of the new breakwater (Dam Tengah) and the west end of the new container terminal; total distance is about 640m

The existing breakwater (Dam CITRA) which functions to protect port facilities, cargo handling operation and navigation channel against waves and sediment material transported by the current flow is planned to be demolished for widening the existing channel and reconstructed along the same alignment of the relocated new breakwater of Dam Tengah by URPT.

The crown height of a newly constructed breakwater (New Dam Tengah) is set at +2.5 m from CDL considering designed wave height of 1.5 m, design wave period of 6 sec and dominating direction of North West. The typical section of new Dam CITRA breakwater at North Kalibaru is shown in Figure 5.1.2-12.

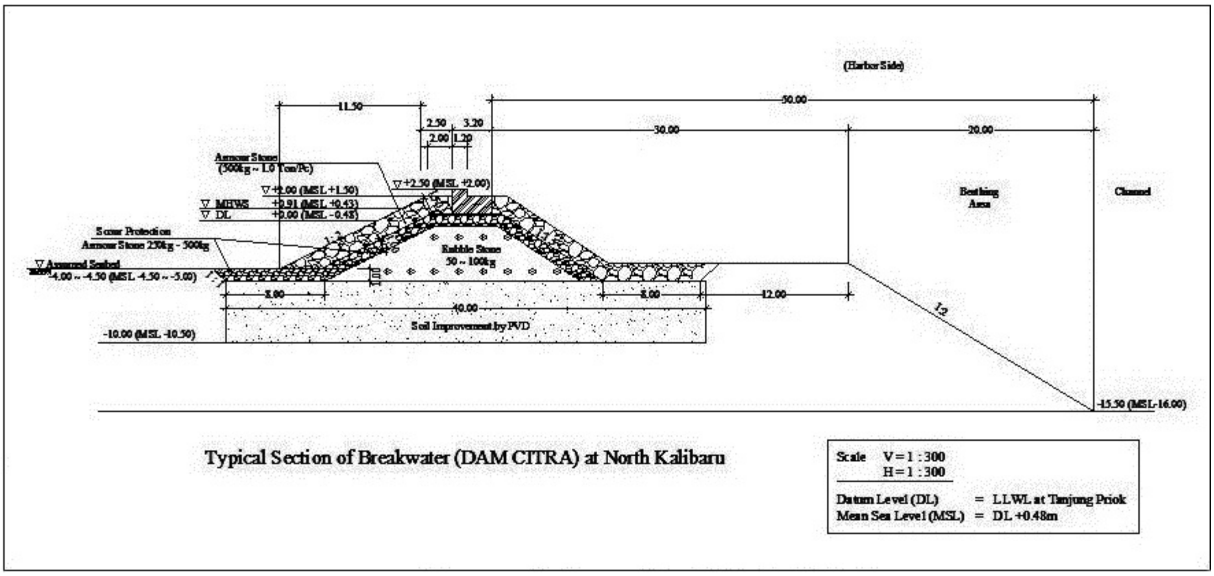


Figure 5.1.2-12 Typical Section of New Dam Citra Breakwater at North Kalibaru

New Seawall for North side reclamation

The yard for new terminals of Phase 1 and 2 is planned to be developed by reclamation toward off shore. The new sea wall of 1,250m length on the north side will be constructed to protect reclaimed land from the wave and sediment material carried by the current with rubble stones piled up and armour stones thereon.

The soil condition of the foundation is soft silty clay at the upper layer of depth -4.5m. This clay material on the surface of sea bed is soft and loose grey sand.

The type of revetment structure for reclamation of North Kalibaru is examined based on the actual experiences of JKT fishing port project constructed in 1981, which is located about 20 km west from the Tanjung Priok Terminal in Jawa Bay. Since then port facilities thereof including revetment and breakwater had been developed and rehabilitated continuously up to 2010.

According to the long term development plan of the new container terminal at North Kalibaru, the sea wall of the reclaimed land is planned as a boundary of phased terminal development. The sea wall structure is designed with the following concept.

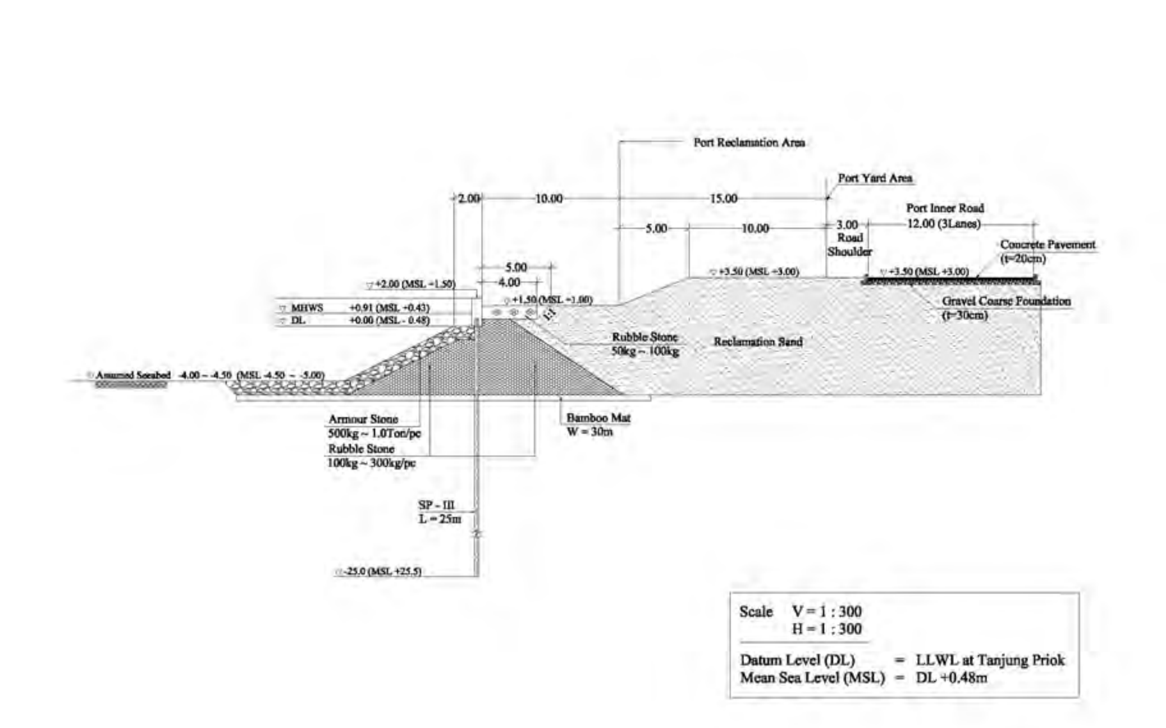
- To accept over topping the crown height of sea wall by design wave
- To allow minimum settlement of sea wall structure; from the experience of JKT Fishing port, it had recorded about 3 cm per year since 1982. The regular rehabilitation works of sea wall structure shall be conducted to maintain the design height by overlaying the sunken parts.
- According to the wave records of the fishing port project for last 25 years the highest wave height was 1.5 m. Therefore, the design wave height is taken at 1.5m. This design wave height is adopted as design wave height for sea wall and revetment design at North Kalibaru, Cilamaya and Tangerang.
- The crown height of the sea wall and revetment is set at HWL + 1/2 Wh (1.5 m)
- They had learned from the experience of JKT fishing port that the bamboo mat had contributed to resisting the circular failure and slide of the slope of reclaimed land. The bamboo mat placement has been effective to support stability of sea wall and revetment structure instead of replacement of soft clay soil by fine sand.

However, as it would be difficult to procure a large volume of bamboo material, the bamboo mat on the existing sea bed before mounding up the rubble stones is not applied in this preliminary design, but considering the necessity of soil improvement as foundation of seawall, breakwater and revetment the standards counter measures of soil improvement is adopted for reinforcement of existing soft sea bed soil.

PVD (Plastic Vertical Drain) methods is planned for improvement of the existing surface soft soil layer, instead of removal of such soft material and replaced by fine sand from the points of the cost, and environmental consideration of dredging and dumping soft material.

It is recommended that the circular slide and failure of the revetment structure with PVD shall be carried out at detailed design stage based on the detailed soil data obtained by field investigation.

The north side sea wall is constructed with steel sheet pile (SSP), which is driven to – 25m and armour stones (500kg to 1.0 ton/pc) are placed on both sides of SSP for stability. In the land side area behind the SSP reclamation sand is filled up to +1.50m (MST +1.00) and about 15 m away from SSP the ground level is gradually increased to +3.50m (MST + 3.0m). The typical cross section of north side revetment is shown in Figure 5.1.2-13.



Source: JICA Study Team

Figure 5.1.2-13 Typical Cross Section of North Side Seawall at North Kalibaru

Revetment of West side / East side

For developing the reclaimed land of the yard area of the new terminal; on both sides of the sea wall on the west side and revetment on east side is required. Considering the local wave (height 1.5m), soil conditions of the foundation and function of service life, type of structure of the sea wall/revetment is designed by Gravity Type (Concrete Block wall is placed on the stone mound from the existing sea bed depth of-4.0 to -4.5m to crown height of +2.5m). Typical cross section of the revetment of west and east sides is shown in Figure 5.1.2-14 and Figure 5.1.2-15.

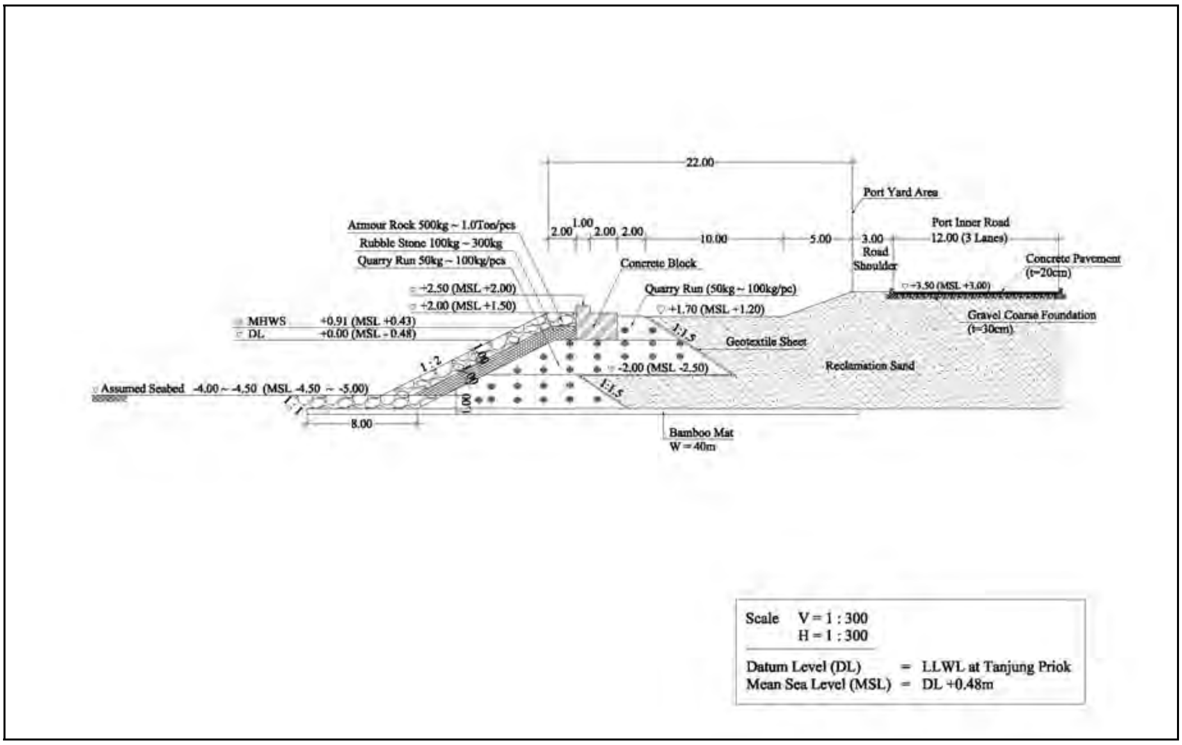
- Seawall/Revetment: Design depth DL-4.0 to 4.5 m, length 600 m constructed with slope of 1: 1.5 on sea side and 1:4/3 on land side by Gravity Type, crown height is set DL +2.5m.
- Wave-absorbing Work; Rubble-stones is placed in front of the seawall/revetment of the yard area and on the slope under the container berth as wave absorbed facilities.

Mangrove planting is planned as a marine eco friendly arrangement between the seawall/revetment and reclamation yard. From the experience of the fishing port project, mangroves are protecting terminal facilities from salty sea breeds.

The armour stone (500 kg to 1 ton/pc) will be placed on the slope of the West side seawall for wave–absorbing and a layer of rubble stones (250 to 500 kg) will be placed on the slope of quarry run (50-100kg/pc), while small armour stones will be placed on the East side revetment considering frequency of design wave height.

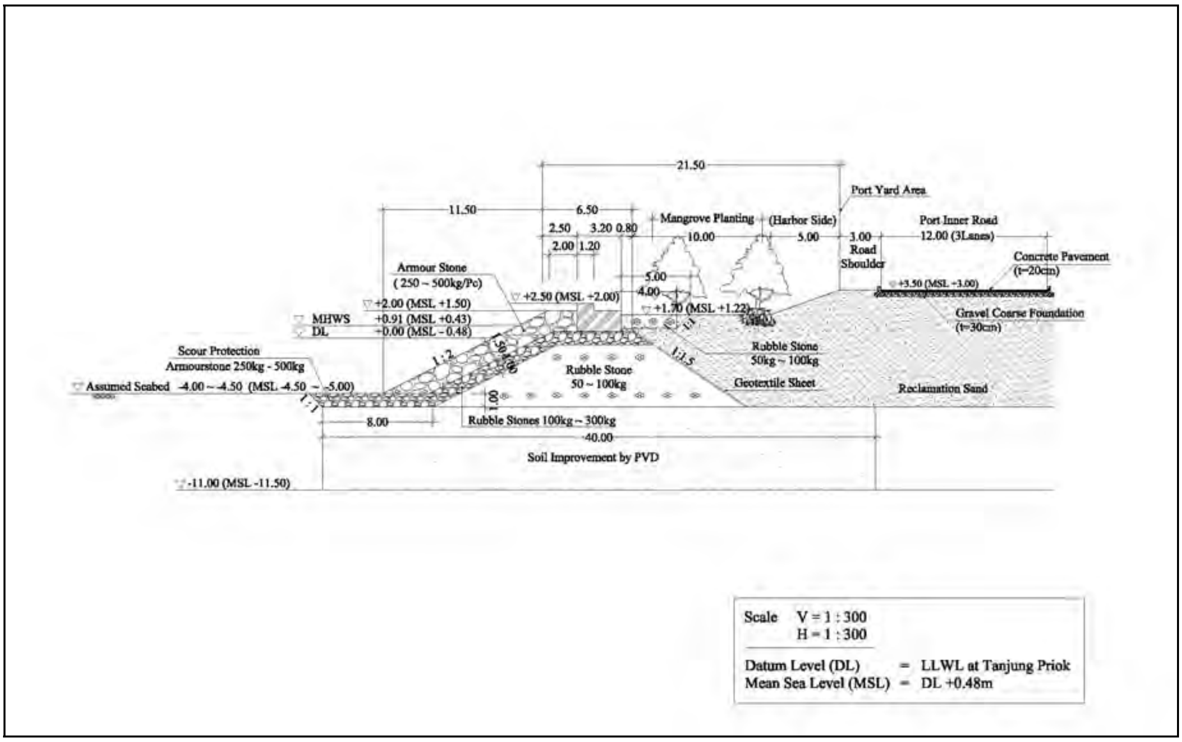
It is planned to recycle existing concrete blocks (around 1 ton size) and rubble stones used in the existing breakwater for construction of the new breakwater and revetment.

For identifying the durability of the existing material for recycling, it is recommended to conduct the detailed soil investigation of the existing breakwater area.



Source: JICA Study Team

Figure 5.1.2-14 Typical Cross Section of Revetment of West side at North Kalibaru



Source: JICA Study Team

Figure 5.1.2-15 Typical Cross Section of Revetment of East side at North Kalibaru

2) Reclamation works

Reclamation volume

Reclamation works will be carried out by filling material such as quarry run and rubble stones taken from the quarry around the project sites. The infill materials will be transported by dump trucks from the existing quarry near the project site. The infill material should be filled from the existing sea bed up to +2.0 m from CDL. Average thickness of reclamation will be 6 to 7 m. The estimated volume for respective phases is shown in the Table below. Average elevation of the planned yard after pavement will be +3.5 m (MSL+3.0m).

Table 5.1.2-17 Reclamation Volume (m3) by Phases at North Kalibaru Development

	Phase 1	Phase 2	Phase 3	Total
Container Berths	3,760,000 3,760,000	15,605,500	25,920,000	49,045,500
East outer Road area	770,000			770,000
Oil berth area			8,952,000	8,952,000
Bulk Terminal area			4,160,000	4,160,000
Total (m3)	8,290,000	15,605,500	39,032,000	62,927,500

Source: JICA Study Team

Soil Improvement

The soil improvement for the reclamation area is considered necessary. Tentatively the PVD Method is considered at the foundation of stock yard, terminal inner roads and building areas. This method is one of the most practical methods of compaction for granular material, however specification of compaction and infill material shall be decided after practicing a series of experimental works.

During the reclamation works, the silt protector shall be placed in the water area in order to prevent the proliferation of water pollution.

(5) Yard Pavement and Drainage in new terminal area

Pavement

Based on the operation plan of the container terminal, the pavement type to be adopted for the usage of respective areas are selected with drainage system as shown in Table 5.1.2-18 for pavement type and Table 5.1.2-20 for drainage system.

Table 5.1.2-18 Critical Wheel Load for Pavement Design

Area Particulars	Access / Service Road	Container Terminal Area		Stock Yard	
		Berth / Apron	Road way	RTG passage way	Stock yard
Critical Wheel Load Type	Standard Truck (H20-44)	Standard Truck (H20-44)	Forklift Truck (25 tf)	RTG (40ft)	Reach stacker (45 tf)
Critical Wheel Load (ton)	8.0	8.0	12.8	40	8.1
Pavement Type	Concrete	Concrete	Concrete	PC slab	Inter-locking Block

PC Slab: Pre-stressed concrete block slab.

Special provision of pre-stressed concrete block slab pavement is adopted for the track of Rubber Tired Gantry crane (RTG) to support 40 tf/wheel.

The pavement of the parking lots and empty container storage areas for container terminal will be by interlocking concrete blocks.

The designs of the pavement for Container Terminal are shown in Table 5.1.2-19. Interlocking Concrete Block (ICB) is recently popular for container terminals on reclaimed area because of easy repair of damages without any special equipment.

Table 5.1.2-19 Pavement Structures for Container Terminal

Pavement Type	Terminal Area	Design Load
Interlocking Concrete Brock (ICB)	Truck Passage	Container Trailer Truck
	Empty Container Yard Container Freight Station Maintenance Shop Container Repair Shop	Container Trailer Truck Reach Stacker Forklift
Asphalt Concrete	Open Area Administration Building	Normal Vehicle
RC Concrete Block + Asphalt	Container Stacking Area	Container (4 tiers)
RC Concrete	RTG Transfer Lane	Rubber Tyred Gantry Crane
	Container Washing Area RTG Anchoring Area Container Gate	Reach Stacker Forklift

Source: JICA Study Team

Drainage

Selection of the drainage type and relevant coefficient for drainage design of the container terminal are summarized in the following table:

Table 5.1.2-20 Drainage Design

	Service Road	Container Yard	Container Stock Yard	Open Stock Yard
Drain Type	L-Type Curb with Catch Basin - Concrete Pipe	U-Type Ditch - Concrete Pipe	Gutter with Catch Basin - Concrete Pipe	Gutter with Catch Basin - Concrete Pipe
Concentration time for Surface Water: Tc (min)	5	5	5	5
Coefficient of Runoff : C	0.95	0.9	0.9	0.9

Source: JICA Study Team

The drainage system for the storm water on the container terminal and the access road in the terminal is considered to evacuate the storm water into the sea/lake by drainage.

There is an outlet of the small outflow of city drainage on the opposite side of the new terminal area, so the diversion drainage is considered to discharge the storm water.

(6) Road in Terminal Development

1) Access Road between Kalibaru Terminal and New Terminal

The construction of the access road to the new container terminal at North Kalibaru is one of the essential components of the urgent project. The access road is planned by extending from the Kalibaru Terminal by bridge on the sea water area to the west end of the reclaimed land of North Kalibaru. This access road construction shall be implemented at the same time as parts of the new terminal development works.

For the Phase 2 development, the access road is planned along the coastal area to connect from the North Kalibaru terminal to Tarmajaya in the Bekasi region through DKI Marunda terminal and

Marunda Center terminal. This planned access road will function mainly as port oriented traffic services road by connecting from the Tanjung Priok Terminal to Karawan Industrial Region in the west Jakarta directly.

The detailed planning and design of access road structure are described in Chapter 5.3 "Access Road Development".

2) Terminal inner Road

The terminal related traffic from the western regions mainly enters in and exits from the port area through the exclusive gate of a new container terminal, which is planned at the western end of the terminal yard, where the access road from Kalibaru Terminal area will be joined.

The new Kalibaru terminal is expected to handle container volume of about 1.9 mil TEU by Phase 1. The inner road of the new terminal is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land.

The terminal inner road is planned to have 12 m width for 3 lanes and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard truck's (H22-44) wheel load of 8.0 ton/wheel. The road is planned to be constructed between the revetment wall and edge of container yards on the east and west sides; the length of the roads will be 600 m on the east and west sides and 1,320m on the north side.

(7) Utility Supply and Buildings

1) Utility Supply

Water Supply

The following volume of water demand for a new container terminal at North Kalibaru in Tanjung Priok Terminal will be required.

The water supply to the vessels, fire fighting and buildings are considered as the same scale as a similar container terminal. The outdoor-hydrant boxes are installed in the Maintenance Shop and CFS. The indoor-hydrant boxes are provided for the other buildings. The water pipes in the terminal area will be connected with the main water line near the project site.

Water supply system included in the Project will consist of water reservoir, pump house, elevated water tank and distribution system for general purpose of the office, ship, hydrant, and fire fighting inside the port area.

The water source should be taken from the main supply line of the public water of the Water Supply Works Department of the DKI. The water supply pits and pipeline along the berth of the new terminal will be provided to supply water to ships.

Table 5.1.2-21 Requirement of Water Supply for New Port Facility Area

Demand	Design
1) Domestic Consumption	
1-1) Average Domestic Consumption per Capita	100 l/day
1-2) Maximum Daily Consumption	+ 30 %
1-3) Losses	10 %
2) Ship Supply	
2-1) 2% of Full Tank for average 10,000 GWT Vessel	200 tons/call
3) Fire Fighting	
3-1) Maximum Reserve	200 tons/day

Source: JICA Study Team

Minimum pressure at the farthest supply point should be 50 psi for the domestic demand and ship supply, while much higher pressure of 65 psi should be provided for fire fighting.

Power Supply

Electric power demand for the container terminal is summarized in Table 5.1.2-22.

The electric power requirement of the Tanjung Priok Terminal will be supplied from the National Electric Cooperation (PLN). A standby generator set for emergency purpose of the office use in the port will be installed.

Table 5.1.2-22 Requirement of Power Supply at New Port Facility Area

Demand Source	Design Values
Gantry Cranes per Unit	1,000 KVA (demand) 4.16 KV, 3 Φ
Reefer Container per Unit	6 KW 440 V, 3 Φ
Lighting	230 V, 3 Φ
Others	230 V, 3 Φ
TOTAL DEMAND	15 MVA

Source: JICA Study Team

Environmental Treatment Facilities

The following environmental treatment facilities will be provided for the new container terminal at North Kalibaru.

- Drainage/sewerage outfall facilities
- Solid wastes management facilities
- Ballast and Bilge Waste Treatment System

Drainage/sewage outfall facilities

The septic tanks as sewerage facilities will be provided at each building and water thereof will flow out through the drainage pipes. Drainage facilities are provided together with the pavement works.

Solid waste management facilities

For the solid wastes management facilities, necessary number of garbage bins are provided and installed inside the port area and the port management office will make an arrangement with garbage collection companies to collect such garbage and take it to the specified garbage dumping site.

Ballast Bilge Waste Treatment System

The “International Agreement for the Prevention of the Sea Water Pollution with Oil came into the Oil of Ship” was enforced in 1990 as domestic law in Indonesia.

This oil treatment plant accepts wasted oil (mainly ballast water and bilge water) directly from smaller coastal service tankers or oil barges.

The proposed ballast and bilge water treatment plant by this master plan is aimed at mitigation potential ship related oil pollution due to indiscriminate disposal of ship based oily waste into port waters. It is noted that the port water is visibly polluted with floating oil, which is an aesthetic nuisance in addition to a water pollution issue.

This is considered as the very first step in controlling potential pollution due to port related activities. Moreover, the provision of ballast and bilge waste treatment by the port is to meet its legal obligation as mandated by the DENR Administration Order No.34 (Water Quality Criteria Amendment Section 68 and 69 issued in 1990).

A bilge water disposal plant, if established, will employ a biological processing where activated sludge by mechanical aeration will accelerate the digestion of organic substances in the bilge water. A bilge water (sewage) disposal plant, effluent from which must comply with the decree put down by Indonesia national laws, will be considered.

2) Building works

All the buildings inside the container terminal, car terminal, passenger terminal and multipurpose berth will be designed in conformity with relevant national codes and standards, such as National Structural Code for Buildings, National Plumbing Code of the Indonesia, Indonesia Electrical Code, Fire Code of the Indonesia, etc. Requirements of the floor area for each building and other criteria are described here.

Required Area of Buildings for the Project

The required floor area of buildings is summarized in the following table.

Table 5.1.2-23 Office and Building Floor Area Requirement (m2)

Buildings	Floor Area	Structure
Container Terminal Building	3,500/2 berths	RC
Container Freight Station	1,500/2 berths	Steel
Container Terminal Gate	1,000/2 berths	RC & Steel
Maintenance & Repair Shop	600/2 berths	Steel
Power Generator House/Substation	300/ 2 berths	RC
Water Supply Reservoir	400/2 berths	RC
Security Office	270/2 berths	RC
Container Inspection Area		RC & Steel

Source: JICA Study Team

(8) Security System Facilities,

The security system facilities are designed so as to satisfactorily comply with SOLAS amendments and ISPS Code which entered into force on 1st July 2004.

The cargo container X-ray inspection system, CCTV system, gate control and fences are considered to meet the requirements of SOLAS and ISPS code. These facilities should be provided in the junction area (about 50 m width x 600m long) with off shore access bridge from the Kalibaru port at the west end of the terminal area.

The large-size X-ray digital radiography is used to inspect the cargoes inside a full container sitting on their trailers. The X-ray equipment is fixed in a building to shield the radiation.

The fences around the terminal area should be 8 feet high (= 2.44m) based on the requirements of SOLAS and ISPS.

5.1.3 New Container Terminal Development at Cilamaya Site

(1) Channel and Turning Basin Development

1) Nautical and Operational Aspects of the candidate site of new terminal

The near-shore waves off the planned new terminal are comparatively mild throughout the year. The predominant waves to the shore at Cilamaya / Ciparage are from the north-east direction.

The currents in and along the coast of planned area are rather weak, resulting in no significant maneuvering problem for incoming/outgoing ships.

The seabed is very gentle slope and the contour lines are mostly parallel to the beach. The shore is stable, in which erosion and sedimentation are not observed. Distances from shoreline to -10 m and -15 m depth are about 5 km and 10 km respectively. Seabed slope is about 1/500 up to about -10 m depth contour line, and between -10 m to -15 m, seabed slope is 1/1000. The area is muddy beach and seabed deposits are mud and fine particles.

Wave conditions at the site are summarized as follows;

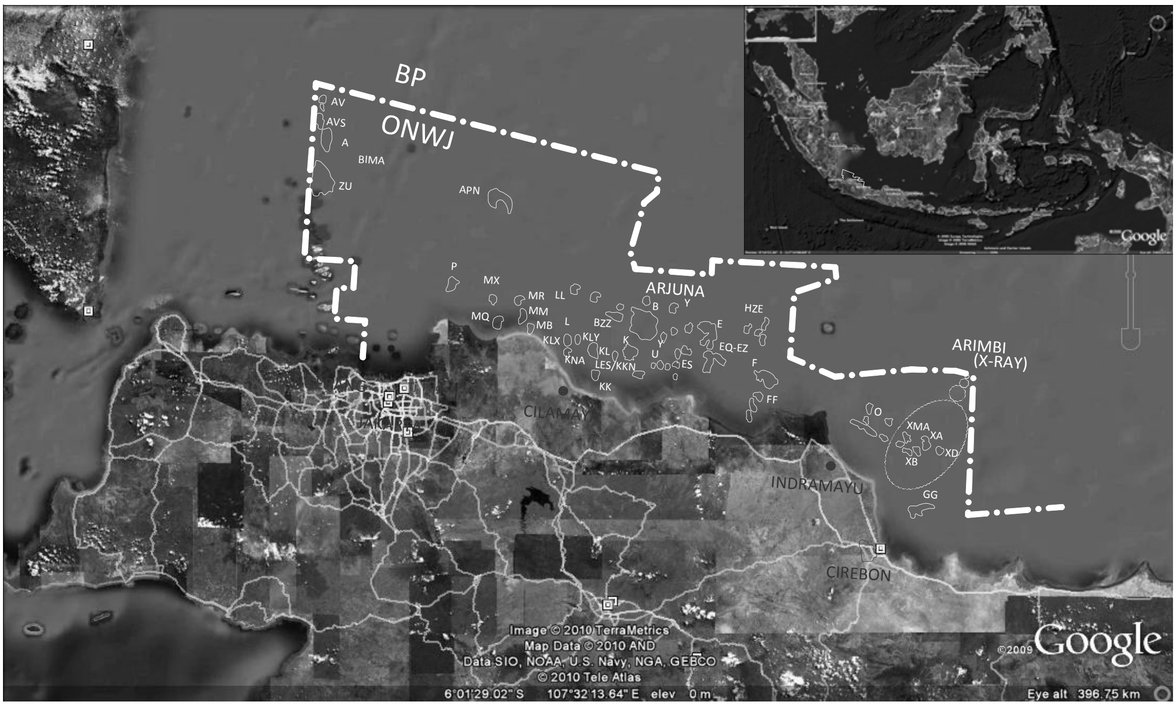
- The wave from west is sheltered geographically
- N & E waves directly approach to the planned terminal area

Percentage of predominant wave height:

- 95.9 % of the waves at -10m depth is less than 0.5 m height

The oil rig platforms are observed in the off shore area in front of the candidate site of the Cilamaya terminal.

According to PERTAMINA, the area concerned is called “Off Shore North West Java (ONWJ). These oil rigs in ONWJ are owned and operated by PERTAMINA. They had developed oil and gas exploration by building the oil rig platforms and installed 20” to 24” submerged pipe lines to connect between the oil rigs at a depth of more than 20m (although some pipelines are installed at depths of less than 15 m along the coast from Bekasi to Indramayu as shown in the Figure 5.1.3-1.).



Source: JICA Study Team

Figure 5.1.3-1 Field Location of Pertamina EP Oil Rig Platform at North Coast of West Jawa

The gas from Cilamaya is supplied to PLTGU Muara Tawar Power plant by pipeline. The area where submerged pipelines are installed can not be used as an anchorage of ships.

According to DINAS PERIKANAN, KELANTAN PETERNAKAN, Kabupaten, Karawang (Karawang Branch Office of Marine Affairs and Fisheries), the irregular shallower parts in front of the planned breakwater of the new container terminal as indicated on the bathymetric survey charts is the coral reef.

They supported the development of a new container terminal in Ciparagi area, however they requested that such off shore facilities be developed at the west side of the Ciparagi River since the provincial government plans to develop this coral reef area as a tourist spot.

Regarding shoreline changes in this area, the southeastern portion of Muara Ciparage shows an obvious backward shoreline change (1940 ~ 1993: -130 ~ -380 m). The yearly rate of shoreline change is estimated at around -3 ~ -7 m/year. No significant erosion was seen in this area for the period 1993 ~ 2009 probably due to protection works.

According to the shoreline change around the small jetty in the Fish Landing Site at Muara Ciparage, it is estimated that the predominant direction of the sediment transport is from west to east in this coastal area.

2) Planning Criteria for Channel/Basin Improvement.

Considering the local conditions of coastal development at Cilamaya area by PERTAMINA oil rig platform and existence of coral reef along the east side of this coast, the alignment of the access channel from the Jawa Sea has been planned to avoid interference with theworking platform of oil /gas exploration and coral reef area (see Figure 4.9.5). The distance to the sea bed depth of -16m from the coast is around 9-10 km. The detailed bathymetric survey at the site shall be carried out for detailed design of the channel planning.

The access channel depth is dredged to -15.5m, CDL (MSL -16.0m).

To receive the design size of vessel the shallow parts less than 16m depth 5-6 km from the new terminal must be dredged to -15.5m. The total length of the access channel is estimated at around 47 km from the entrance of the new terminal.

The expected maximum ship size to call the Port is set as Post-Panamax. To receive this size of vessel the basic space requirements of the navigation channel and basin will be determined as follows.

Table 5.1.3-1 Objective Ship Size for planning Access Channel

Objective Container Ship Size	87,545DWT, D=14.0m, LOA=318m, B=40.06m
Depth and Width of Channel	D=15.5m, W=310m
Depth and Width of Turning Basin	D=15.5m, W=640m
Depth of Berth and Length	D=15.5m, L =360m

Source: JICA Study Team

To allow two-way traffic of 87,000 GT vessels the new access navigation channel is set at 310 m in width and 15.5 m in depth. The channel width meets international standards and the water depth requirements are reasonable. The turning circle is planned to be two times LOA (640 m) in diameter and have a depth of -15.5m.

3) Proposed Scope of Channel Improvement

Dredging Requirements for Navigation Channel

The dredging requirement is estimated by superimposing the proposed channel/basin improvement plan on the bathymetric survey produced by the JICA Study Team. The water depth for dredging has been set at -15.5 m at the channel and turning basin and side slope of the dredging section is assumed to be 1 to 5.

The net volume of dredging requirements for the long term plan is summarized below. The location of each area is shown in Figure 5.1.3-2. The outer channel dredging is planned up to the sea bed depth of -15.5 m CDL from the Sea Chart.

A detailed hydrographic survey should be conducted to determine the exact location of bending points and its depth and estimate dredging volume in the planned alignment of the access channel at the detailed design stage.

Table 5.1.3-2 Dredging Volume Requirement in Long Term Plan

Location	Design Depth	Dredging Volume (m3)		
		Phase 1	Phase 2	Total Volume
Outer Channel	-15.5m	11,486,000		11,486,000
Turning Basin at Access Channel	-15.5m	2,679,700		2,679,700
West Turning Basin + Quay 3	-15.5m	1,360,500		1,360,500
East Turning Basin + Quay 6	-15.5m	1,551,700		1,551,700
Inner Turning Basin + Quay 1	-15.5m	3,809,500		3,809,500
Inner Turning Basin Quay 2	-12.5m	6,837,600		6,837,600
Small Boat Basin	-4.0m		204,500	204,500
Total Volume		27,725,500	204,500	27,930,000

Source: JICA Study Team

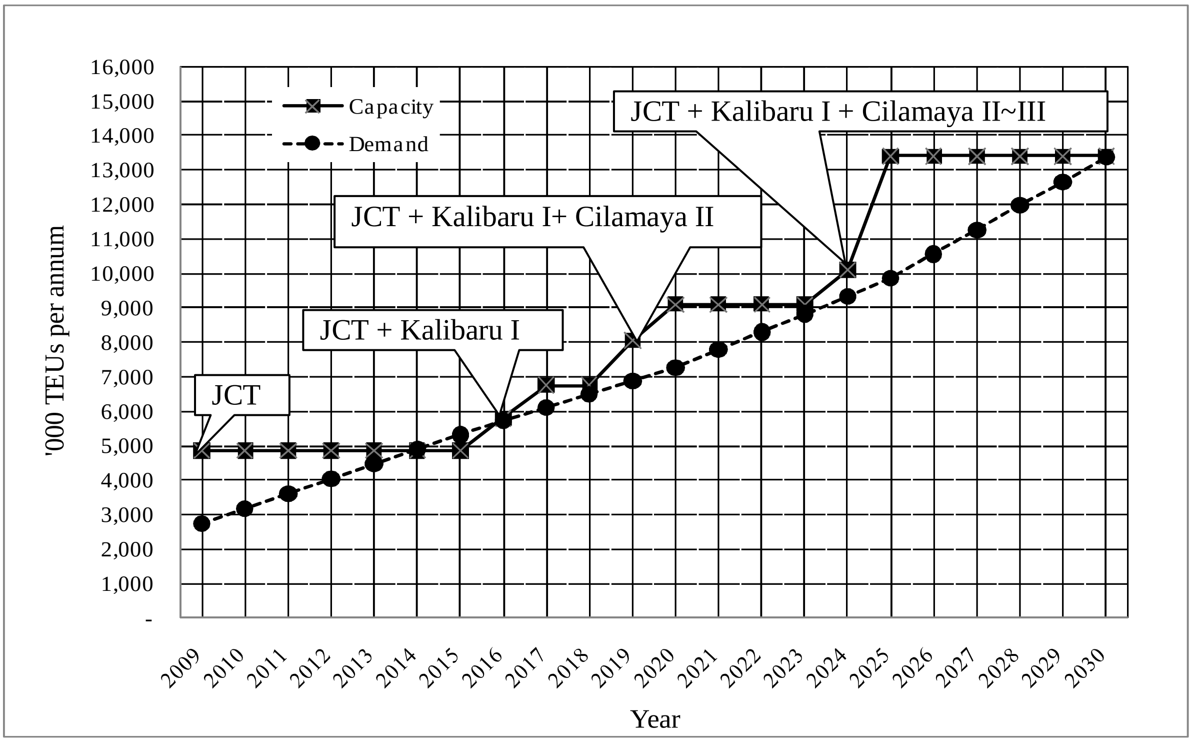
Construction of breakwater for the long term development plan

Figure 5.1.3-3 shows the long term development plan of Cilamaya new container terminal. Long term development of Cilamaya new terminal is planned to develop toward the off shore. In order to protect the terminal facilities it is planned to construct a new breakwater with a length of 2,130m and seawall with a length of 4,680m for development about 3.6-4.0 km away from the existing shore line of Cilamaya coastal beach. The detailed construction plan of the new breakwater is described in Chapter 5.1.1.

(2) Preliminary Design of Quay wall Development

1) Phased Development of New Terminal at Cilamaya

The new container terminal at Cilamaya is planned to be developed after the first phase of North Kalibaru terminal then the Cilamaya terminal will be developed by phases according to the progress of traffic demands as shown in the following graph.



Source: JICA Study Team

Figure 5.1.3-2 Phased Development of New Container Terminal

2) Phased Berths Development Plan

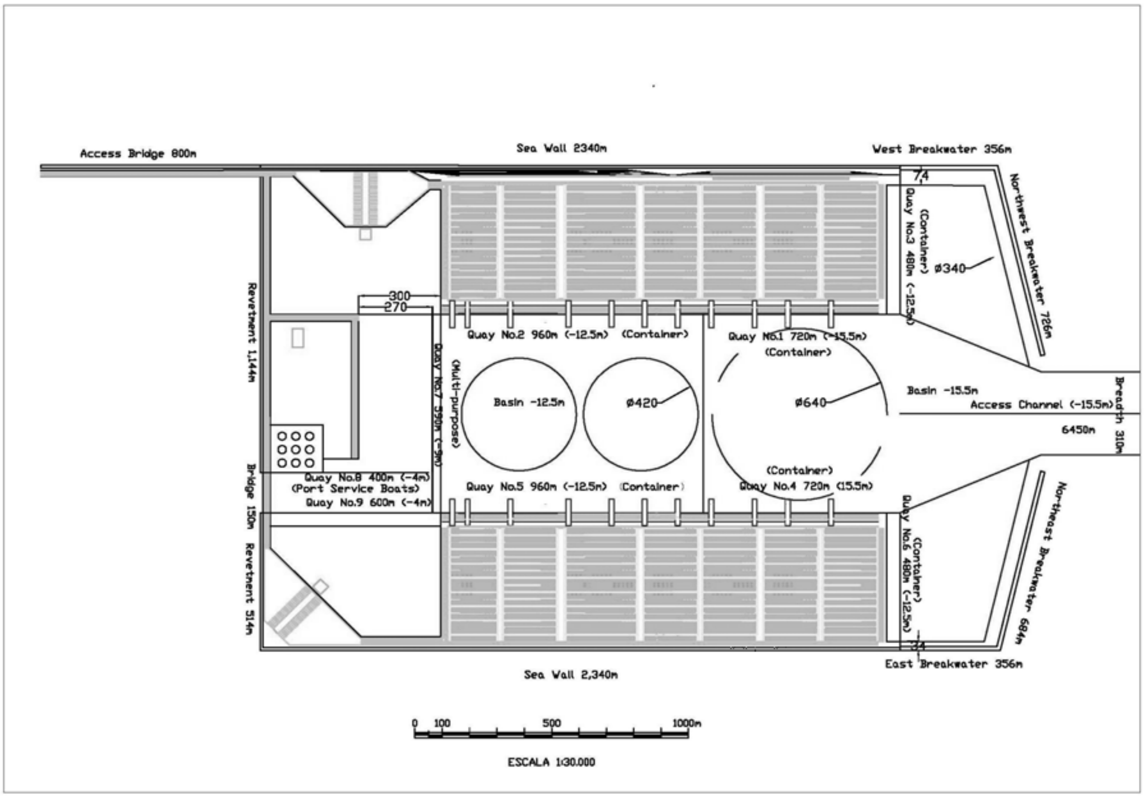
Required number of container berths to meet traffic demand is calculated assuming that the urgent new terminal development will be carried out at North Kalibaru in Tanjung Priok to meet the traffic demands by 2019.

Table 5.1.3-3 Phased Development of Terminal Facilities at Cilamaya

Cilamaya Phase 1 (2019 - 2025)	Target of Capacity: 5.4 million TEU	
Quay No.1 (-15.5 m):	2 berths@360 m = 720 m,	1.4 million TEU
Quay No.2 (-12.5 m)	4 berths@240 m = 960 m	1.4 million TEU
Quay No.3 (-12.5 m)	2 berths@240 m = 480 m	0.7 million TEU
Breakwaters and Revetment construction, Channel and basin development by dredging are carried out, Access road and railway connection are carried out.		(Capacity Development: +3.5 million TEU)
Cilamaya Phase 2 (2025 - 2030)	Target of Capacity: 9.4 million TEU	
Quay No.4 (-15.5 m)	2 berths@360 m = 720 m	1.4 million TEU
Quay No.5 (-12.5 m)	4 berths@240 m =960 m	1.4 million TEU
Quay No.6 (-12.5 m)	2 berths@240 m = 480 m	0.7 million TEU
Quay No.7 (- 9.0 m)	3 berths@200 m = 600 m	0.5 million TEU
Revetment extension works, Basin development by dredging are carried out		(Capacity Development: +4.0 million TEU)

Source: JICA Study Team

The long term development plan of new Cilamaya terminal facilities is shown in the Figure below.



Source: JICA Study Team

Figure 5.1.3-3 Long Term Development Plan of Cilamaya New Terminal

3) Code and Standards for Preliminary Design of Quay wall

The design criteria of marine and civil works conform to the same design standards and reference as applied for North Kalibaru new terminal development described in Chapter 5.1.2.

4) Design Criteria

The detailed design criteria are described in Section K, SRES.

The same design criteria of marine and civil works as described in Chapter 5.1.2 are applied and the supplementary detailed design criteria as described in Section K, SRES are also applied, except the objective ship size, soil and wave conditions of Cilamaya site.

Objective ship size

It is assumed that the following two different sizes of container ships will use the new terminal. The dimensions of the container ships used for the new terminal are summarized below.

Table 5.1.3-4 Objective Container Ship Size

Type of Container Ship	Post-Panamax	Medium Size
Dead Weight Ton (DWT)	87,545	33,750
Loading Volume (TEU)	5,648	2,550
LOA (m)	318	207
Beam (m)	40.06	29.84
Draft (m)	14.0	11.4

Source: Containerization International

Tide and wave conditions at Cilamaya

The tide level and wave conditions at Cilamaya region is summarized below for conducting the preliminary design of terminal facilities.

Table 5.1.3-5 Tide, Current and Wave Conditions of Cilamaya Site

	Cilamaya site
Tide (cm)1	
High Water Level (HWL)	+107.00 CDL (MSL +59.0)
Mean Sea Level (MSL)	+59.00 DL(MSL +0.00)
Design Low Tide Level (DLT)	0.0 DL(MSL – 48.0)
Wave at Berth,	
Significant Wave Height H1/3(m)	0.50 m
Significant Wave Period T1/3	Less than 2 sec
Wave at Revetment	
Design Wave Height (m)	1.5 m
Design Wave Period (sec)	Around 6 sec
Wave at Breakwater	
Significant Wave Height H1/3 (m)	3.00m
Significant Wave Period T1/3	Around 9 sec

Source: JICA Study Team by site observation record in 2010 May/June

Subsoil Condition

The location of bore holes of soil investigation carried out by JICA Study in 2010 and its detailed soil profiles of Cilamaya area are shown in Section K, SRES.

According to the geotechnical investigation of the candidate terminal development area at Cilamaya, the following parameters as soil conditions are taken from BH 1, which is used for the preliminary design for the new terminal facilities. This bore hole is the exact point where the off shore terminal will be developed.

Table 5.1.3-6 Soil Profile for Preliminary Design

BH 1 Off shore of Ciparage Site		
Depth from Existing sea bed (-5.0m)	Elevation from DL 0.00	Soil Profile
- 4.0 m	-9.0m	Silty Clay to sandy clay very soft grey in color N= 0 ~ 2
- 8.0m	-13.0 m	Clay o clayer silt mixed with fragmented shell, stiff consistency N= 8 ~18 ϕ = 30°, γ' = 1.37 tf/m3
-12.0 m	-17.0m	Sandy Clay hard consistency N= 18 ~- <60 ϕ = 30°, γ' = 1.79 tf/m3
-20.0 m	-25.0m	Clayer silt very stiff consistency, N = <60 ϕ = 30°, γ' = 1.86 tf/m3
-30.0 m	-35.0m	Sandy Clay hard consistency N = more than 50 ϕ = 35°, γ' = 1.77 tf/m3

Source: JICA Study Team

Crown Height of Quay wall

As a preliminary design of the container quay wall structure at Cilamaya site, the crown height is set at 3.5m from DL (+3.0m from MSL) considering the ship size and required efficiency of cargo handling operation.

HWL + 2.0 m + H1/3 = + 3.5 m

5) Selection of Quay wall structures

Considering the similar site condition and soil conditions, same seismic coefficient, live loads of cranes, vehicles of the Cilamaya sites, the same type of quay wall structures i.e.; "Concrete Deck on Open Steel Pipe Pile type" as designed for North Kalibaru in Tanjung Priok is applied for the new terminal at Cilamaya.

The corresponding dimension of berthing facilities for the objective ship size is set as follows:

Table 5.1.3-7 Berth Dimension Corresponding Ship Size

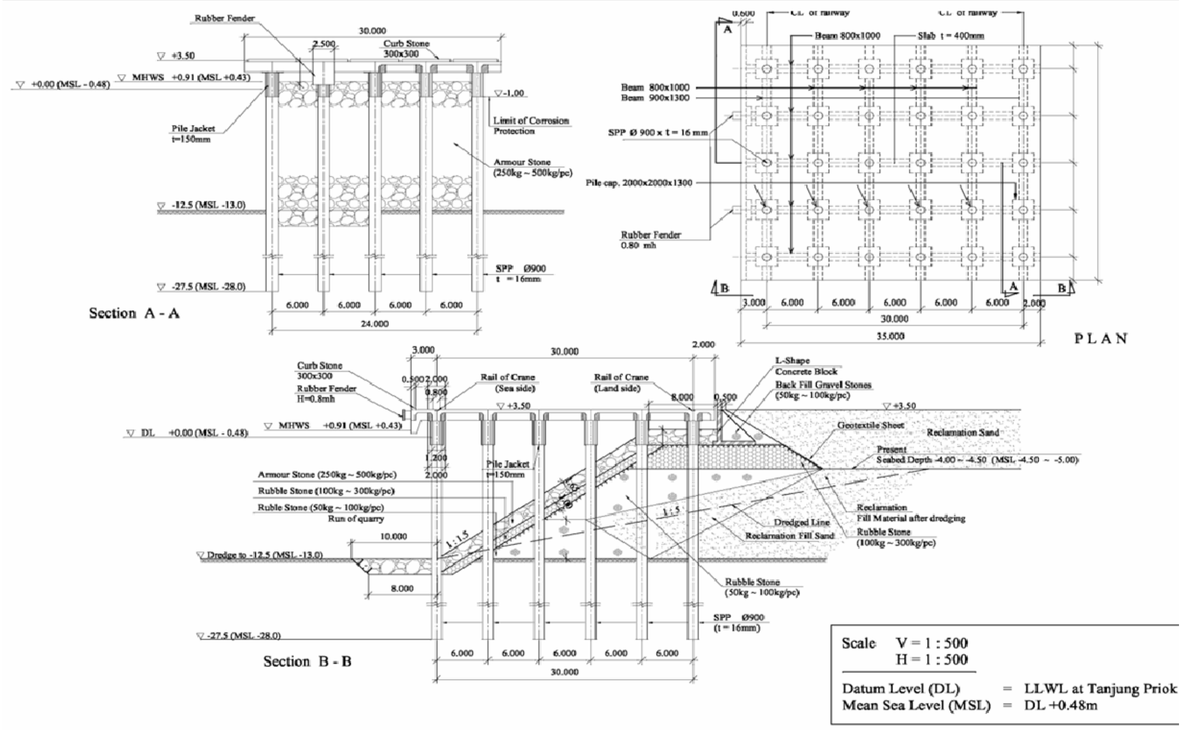
Type of Ship	Berth Dimension		Diameter of Turning Basin (m)
	Depth (m)	Length (m)	
Medium Size ((33,750DWT)	12.5	240	420
Post- Panamax (87,545DWT)	15.5	360	640
Small Size	9.0	200	-

Source: JICA Study Team

The quay wall for medium size is designed considering the following elements, although dead and live load on the quay wall is the same as 87,000 DWT.

- The berthing reaction of 33,750 DWT by fenders is about 120 to 130 tons
- The water depth in front of berth is set at -12.5m, shallower than Post panamax and,
- The hard layer is encountered at a depth of around -25 m of the site soil condition.
- As a result of stability checking the foundation pile (SPP) size is deduced to Ø900mm, t=16mm from the case of Post Panamax and penetration length is estimated up to-28 m (MSL -28.5m)

The typical cross section of Quay wall structure for Medium size (-12.5mdepth) is shown in Figure 5.1.3-4 below. The cross section of Quay wall for Post-Panamax (-15.5m) is the same as applied for North Kalibaru and shown in Figure 5.1.2-8.



Plan and Section of Steel Pipe Pile (SPP) Type Quaywall (-12.5m) at Cilamaya Terminal

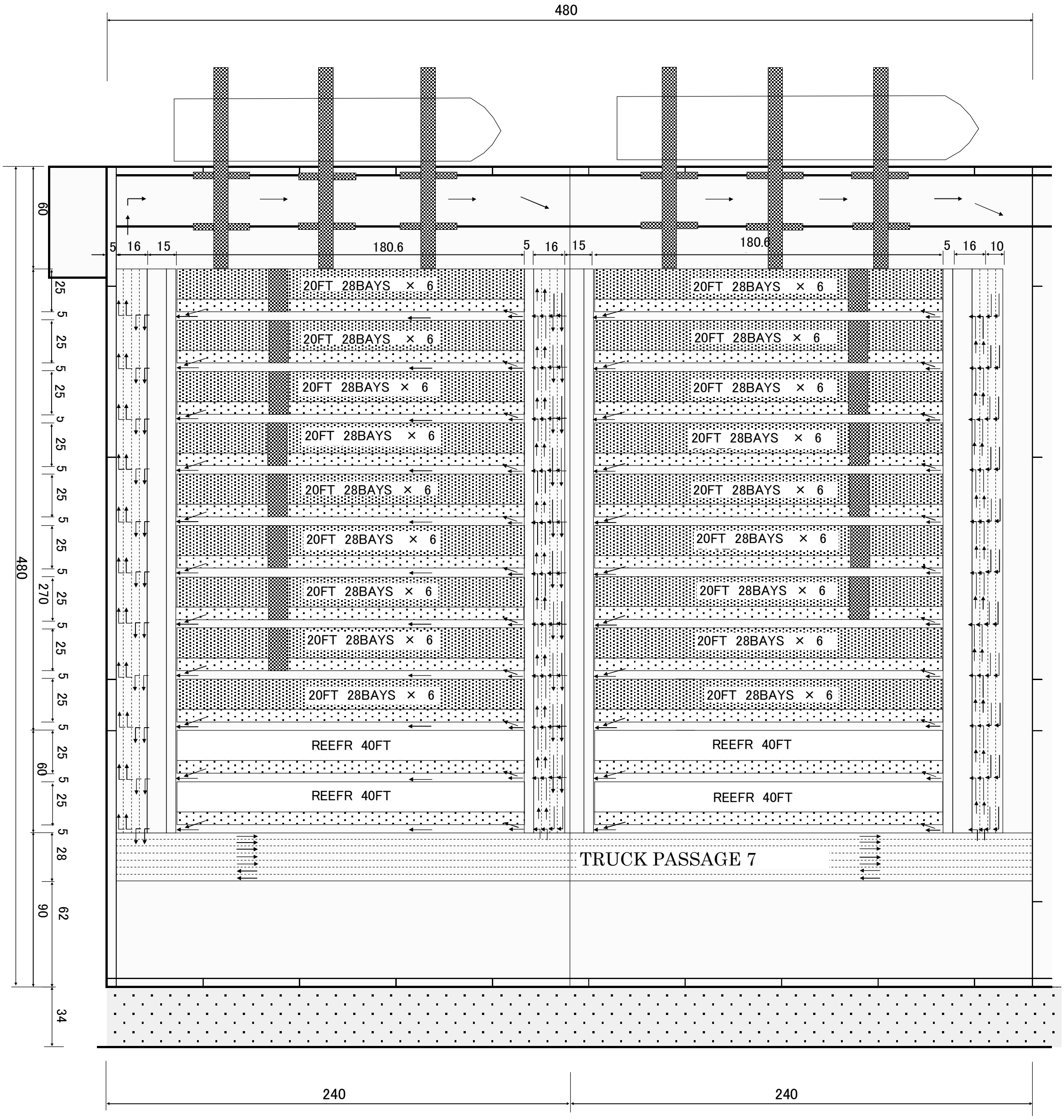
Source: JICA Study Team

Figure 5.1.3-4 Plan and Section of Quay wall (-12.5m) at Cilamaya

(3) Yard Development by Reclamation

1) Layout Plan of Container Terminal

Planned layout of the Cilamaya terminal is shown in Table 5.1.3-6. Thee berth is 240m in length, which involved building quays of 4,910m in total length of quays 2 phases. The space in the back up area is 480m with the exception of the bank space.



Source: JICA Study Team

Figure 5.1.3-5 Container Yard Layout (240m*2berth)

2) Design Conditions for Required Number of Container Handling Equipment

Design condition of estimated required container handling equipment for 1 berth is shown in Table 5.1.3-8. And required quantity and type of cargo handling equipment are listed in Table 5.1.3-9.

Table 5.1.3-8 Design Condition of 1 berth (240m)

Capacity (TEUs/Year/berth)	384,000
Av. Days of Stock	3.3
Stacking Efficiency	0.75
Peak Ratio	1.3
Feeder Ratio	0.02
Yard Capacity(TEUs)	5,900
Tier	4
Calculated Ground Slots(TEUs)	1,475

Source: JICA Study Team

Table 5.1.3-9 Required type and quantity of Cargo Handling Equipment per 1terminal (720m)

CGC	6
Yard tractor	36
Yard chassis	38
RTG	15
Top Lifter	3
Forklift 5t	6
Forklift 10t	6

Source: JICA Study Team

Berth composition is worked out based on the terminal facilities as planned to meet the traffic demands and listed in Table 5.1.3-10. Based on the planned terminal facilities, number of berths is 19, the total length is 4,910m. The water depth of berths is from 9.0m to 15.5m. Proposed container yard area, ground slots, required number and type of container handling equipment are worked out and listed in Table 5.1.3-11.

Table 5.1.3-10 Planned Berth Composition (at Cilamaya New Terminal)

Phase Ⅰ	Water depth (m)	Length (m)	Berth	Subtotal (m)
No.1	15.5	360	2	720
No.2	12.5	240	4	960
No.3	12.5	240	2	480
No.1-No.3			8	2,160
Phase Ⅱ	Water depth (m)	Length (m)	Berth	Subtotal (m)
No.4	15.5	360	2	720
No.5	12.5	240	4	960
No.6	12.5	240	2	480
No.7	9.0	200	2	400
		190	1	190
No.4-No.7			11	2,750
Total (m)			19	4,910

Source: JICA Study Team

3) Long term Planned Cargo Handling Equipment of Phased Development of Terminal Area

Proposed container yard and required cargo handling equipment of the new container terminal at North Kalibaru for phase 2 and 3 stages are worked out and listed in Table 5.1.2-15 based on the similar concept of the Phase 1 North Kalibaru for estimating required cargo handling equipment.

Table 5.1.3-11 Proposed Type and Quanity of Container Handling Equipment (Cilamaya)

	Phase Ⅰ	Phase Ⅱ	Total
Berth Length (m)	2,160	2,750	4,910
Depth (m)	12.5～15.5	9.0～15.5	
Capacity(million TEUs)	3.5	4.0	7.5
Ground Slot(TEUs)	10,202	15,225	25,427
QGC No.	24	30	54
Yard tractor	144	181	325
Yard chassis	152	194	346
RTG	60	75	135
Top lifter	12	15	27
Forklift 5t	24	30	54
Forklift 10t	24	28	52

Source: JICA Study Team

(4) Yard Development by Reclamation

1) Seawall and Revetment Construction

New Revetment for West and East sides of Reclamation

The yard for new terminals of Phase II and III is planned to be developed by reclamation from the off shore to the shore side. The new sea wall of both sides (2,340 m x 2 =4,680m in total length) will be constructed with rubble stones piled up and armour stones thereon to protect reclaimed land from the wave and sediment material carried by the current.

The soil condition of the foundation is clay at the upper layer of depth -4.5m. This clay material on the surface of sea bed is soft and loose sand grey. Considering the soil conditions of the revetment foundation area, type of structure of the revetment is designed by Gravity Type (concrete block wall is placed on the stone mound from the sea bed depth of-4.0 to -4.5m).

The type of revetment structure for reclamation of Cilamaya site is examined based on the actual experience of JKT fishing port project carried out in 1981, which is adopted for the design of the North Kalibaru new terminal.

According to the long term development plan of the new container terminal, the revetment of both sides of the reclaimed land is designed as permanent structure. The revetment structure is designed with the same concept as adopted for North Kalibaru.

The crown height of a newly constructed revetment is set at +2.5 m from CDL considering designed wave height of 1.5 m, design wave period of 6 sec and dominating direction of North East.

Both sides of the revetment are constructed with rubble mound, armour stones and concrete block to be placed on the top of the stone mound. The armour stone (500kg to 1.0 ton type) will be placed on the slope of the off-shore side of the seawall/ revetment for wave–absorbing facilities and layer of rubble stones (250 to 500 kg) will be placed on the slope.

Behind the concrete block the reclamation sand is filled up to +1.50m (MSL +1.00) and about 15 m away from concrete block the ground level is gradually increased to +3.50m (MSL + 3.0m).

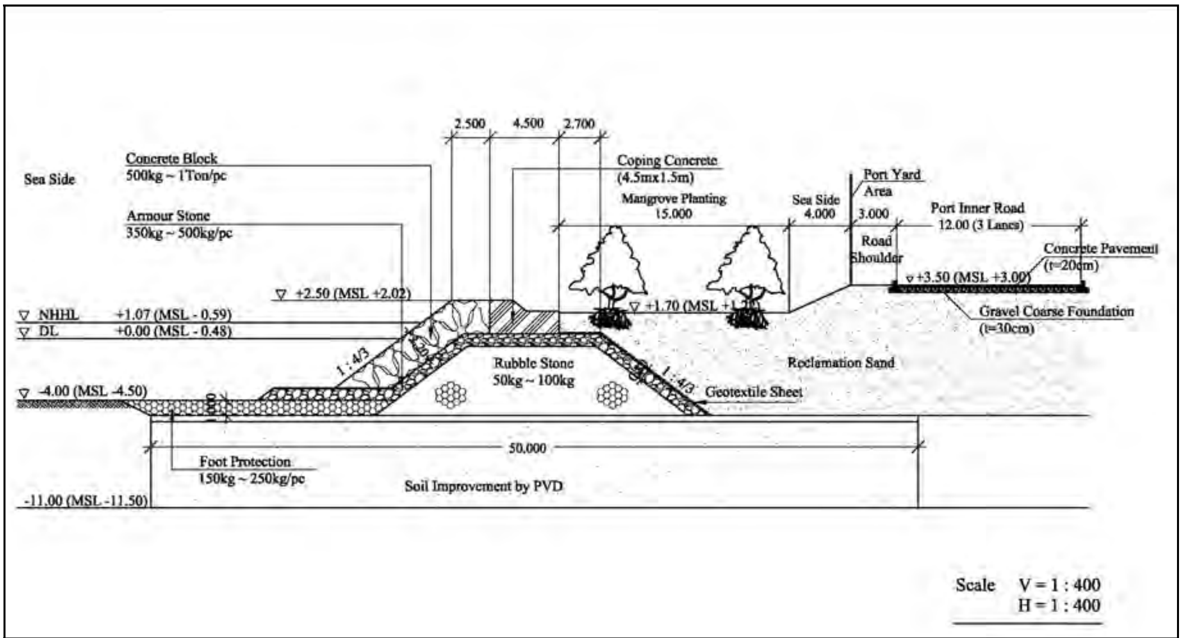
The typical cross section of seawall of the east side is shown in Figure 5.1.3-6, while the seawall on the west side which will be affected by wave over topping will have gravel stones behind the concrete blocks on the mound for wave-absorbing as shown in Figure 5.1.3-7.

Mangrove planting is planned as a marine eco friendly arrangement between seawall and reclamation yard. From the experience of the fishing port project, mangroves are protecting terminal facilities from salty sea breeds.

It is recommended that the circular slide and failure of the seawall structure with PVD shall be carried out at the detailed design stage based on the detailed soil data obtained by field investigation.

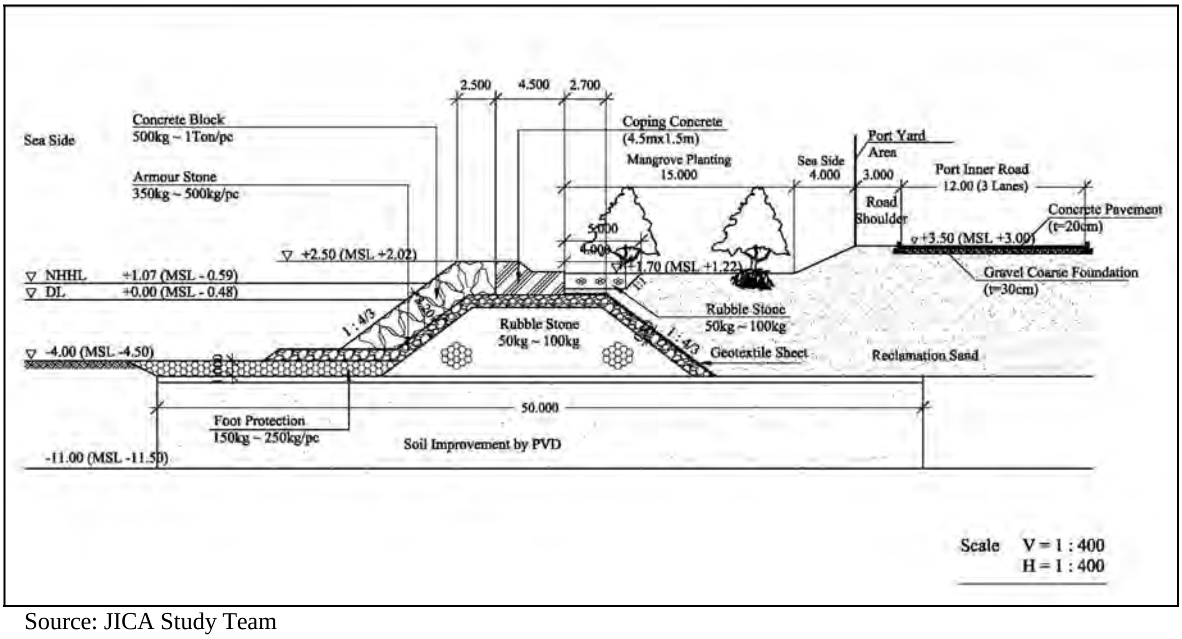
Revetment construction on the south side of reclaimed land

The revetment on the south side facing to the coast area is planned for reclamation works of off shore island with the same concept as adopted for revetment construction in 5.1.2 (4). This revetment is constructed with rubble mound type with soil improvement by PVD as designed for North Kalibaru West side revetment. The typical section of planned revetment is the same as shown in Figure 5.1.2-14.



Source: JICA Study Team

Figure 5.1.3-6 Typical Cross Section of Revetment of East Sides at Cilamaya



Source: JICA Study Team

Figure 5.1.3-7 Typical Cross Section of Revetment of West Sides at Cilamaya

2) Reclamation works

Reclamation volume

The soil conditions from the seabed indicate that the dredged material is not suitable to be used for the reclamation material. It is planned to obtain such reclamation material from out side of the project area.

Reclamation works will be carried out by filling material such as quarry run and rubble stones taken from the quarry around the project sites. The infill materials are transported by dump trucks from the existing quarry near the project site. The infill material should be filled from the existing sea bed up to +2.0 m from CDL. Average depth of reclamation will be 6 to 7 m. The estimated volume for respective phases will be shown in the Table below. Average elevation of the planned yard after pavement will be +3.5 m (MST+3.0m).

Table 5.1.3-12 Reclamation Volume (m3) by Phases at Cilamaya Development

Area of Reclamation	Phase 1	Phase 2	Total
Container Berths QW1 area (15.5m)	4,550,000	4,200,000	8,750,000
Container Berth QW2 area (12.5m)	5,520,000	5,060,000	10,580,000
Multipurpose Berth area	n.a	3,372,500	3,372,500
Terminal Service area	3,090,000	3,090,000	6,180,000
Railway Area	475,134	n.a.	475,134
Total (m3)	13,635,134	15,722,500	29,357,634

Source: JICA Study team

Soil Improvement

The soil data obtained from the investigation indicates that there is sandy stiff and hard layer around the depth of -12 to 14 m from the existing sea bed of -5.0m. The soil improvement for the reclamation area shall be studied carefully based on results of detailed soil investigation.

Considering such soil conditions of the existing surface of sea bed, the PVD Method is adopted for soil improvement at the foundation of stock yard, railways, roads and building area on the shore area may be considered applicable, since this method is one of the most practical methods of compaction for granular material. However the specification of compaction and infill material shall be decided after practicing a series of experimental works.

(5) Yard Pavement and Drainage in new terminal area

Since the operation planning inside the container terminal at the Cilamaya new terminal will be the same as North Kalibaru, the pavement type for the usage of respective areas is selected according to the same type and quality as adopted for North Kalibaru case for each type and area of the pavements. The drainage system will be planned together with the pavement works.

(6) Terminal inner road development

1) Access Road Connection from the Toll way to the Port

The new access road connecting from the regional industrial complex to the planned new termiinal is required for operating the Cilamaya new terminal. The detailed planning of alignment from the existing toll way of Jakarta and Cikanpek and design of access road structure are described in Chapter 5.3 “Access Road Development”.

2) Terminal inner Road

The port related traffic from the hinterland enters and exits from the terminal area through the exclusive gate to be established at the eastern end of the terminal yard by a bridge (2 lanes, L= 800m) connecting to off shore terminal, where it is planned that the access railway from Cikaran dry port area will be joined in the long term plan. The off shore terminal is planned about 800 m away from the present coastal line in order to minimize sedimentation and erosion of the existing coast by development of off shore terminal.

The Cilamaya new terminal is expected to handle container about 7.5 mil TEU by 2030 (Target of handling capacity by 2019 as Phase 1 is 3.5 mil TEU and by 2025 as Phase 2 is 4.0 mil TEU).

This means that about 7.5 mil truck chassis are required in 2030 annually to transport containers. The terminal inner road in the new terminal is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land outside the container yards.

The terminal inner road is planned to have 12 m width for 3 lanes and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard trucks (H22-44) wheel load 8.0 ton/wheel.

The inner road is planned to be constructed between the sea wall and edge of container yards on east sides L= 2,340 m for Phase II project and west side L=2,340 m for Phase III project. The terminal inner road on the south side of the terminal service area L=1,140m is constructed for Phase II project and L= 660 m is constructed as Phase III project.

(7) Utility supply and Buildings

1) Utility Supply

Water Supply

Water supply system will consist of water reservoir, pump house, elevated water tank and distribution system for general purpose of the office, ship, hydrant, and fire fighting inside the terminal area. The water supply to the vessels, fire fighting and buildings are provided. The water supply pits and pipeline along the berth will be provided to supply the water to ships.

The same volume of water demand as North Kalibaru terminal Phase 1 will be required for each phase development of Cilamaya new terminal.

The outdoor-hydrant boxes are installed in the Maintenance Shop and CFS. The indoor-hydrant boxes are provided for the other buildings. The water pipes in the terminal area will be connected with the terminal water reservoir.

It is assumed that the water source to the new terminal should be arranged from the main supply line of the public water of the Water Supply Works Department of the Karawang Regency.

Minimum pressure at the farthest supply point should be 50 psi for the domestic demand and ship supply, while much higher pressure of 65 psi should be provided for the fire fighting.

Power Supply

The same electric power demands for new container terminals as provided at North Kalibaru will be required for each phase development of Cilamaya new terminal.

It is assumed that the electric power requirement of the new terminal at Cilamaya should be arranged from the regional power supply station of National Electric Cooperation (PLN). A standby generator set for emergency purpose of the office use in the new terminal will be installed.

Environmental Treatment Facilities

The following environmental treatment facilities as planned for North Kalibaru will be provided for each phase development of the new container terminal at Cilamaya.

- Drainage/sewerage outfall facilities
- Solid wastes management facilities
- Ballast and Bilge Waste Treatment System

2) Building works

All the buildings inside the container terminal will be designed in conformity with relevant national codes and standards, such as National Structural Code for Buildings, National Plumbing Code of the Indonesia, Indonesia Electrical Code, Fire Code of the Indonesia, etc. The same size of floor area for each building as provided for North Kalibaru is planned to provide for a new container terminal at Cilamaya.

(8) Security System

The security system facilities as planned for North Kalibaru is planned for the new terminal at Cilamaya to comply with SOLAS amendments and ISPS Code in order to function as an international container terminal.

The cargo container X-ray inspection system, CCTV system, gate control and fences are considered to meet the requirements of SOLAS and ISPS code. These facilities should be provided in the gate area junction with off shore access bridge from the Ciparagi at the east end of the terminal area.

5.1.4 New Container Terminal Development at Tangerang Site

(1) Channel Development

1) Nautical and Operational Aspects of candidate site of new terminal

Topographic conditions

The topographic condition of the planned site is a low and flat area with muddy beach. There are many fishing grounds off the coast. The area of the candidate site is on the coast between Tanjung Kait and Tanjung Burung. Between these two capes, rivers such as Ci Rarab and Ci Tuis and S. Apuran flow into the sea.

The Sugai Cisadane is the largest river and its estuary is Tanjung Burung and Tanjung Pepuloa in the candidate site. The area is mostly flat between Tanjung Kait to Ci Rarab. Some villages are found close to the coast from Ci Rarab to Tanjung Burung. There are marshy and fish ponds down close to the beach. There are fairly high trees near the coastal area.

Hydrographic condition

Distance from shoreline to -10 m and -15 m water depths are 4 km and 7.5km respectively. The shore is generally gentle with its slope of 1/400. The seabed is a very gentle slope and the contour lines are mostly parallel to the beach. The soil conditions of this area are muddy beach and seabed deposits are mud and fine particles.

However, scattered islands are found about 10 to 18 km away in the north from the candidate site of the new terminal, where the depth is about 20 m and 33m respectively. The contour lines are rather complicatedly formed off the coast of Tangerang.

The near-shore waves off the planned terminal area are comparatively mild throughout the year.' The predominant directions of waves to the new terminal are from the Northwest.

The currents in and around the new terminal are rather weak, resulting in no significant maneuvering problem for incoming/outgoing ships.

Wave conditions at the site are summarized as follows;

- The wave from the east is sheltered geographically
- N & W waves are directly approach to the new terminal area

Percentage of predominate wave height:

- 95.9 % of the waves at -10m depth is less than 0.5 m in height

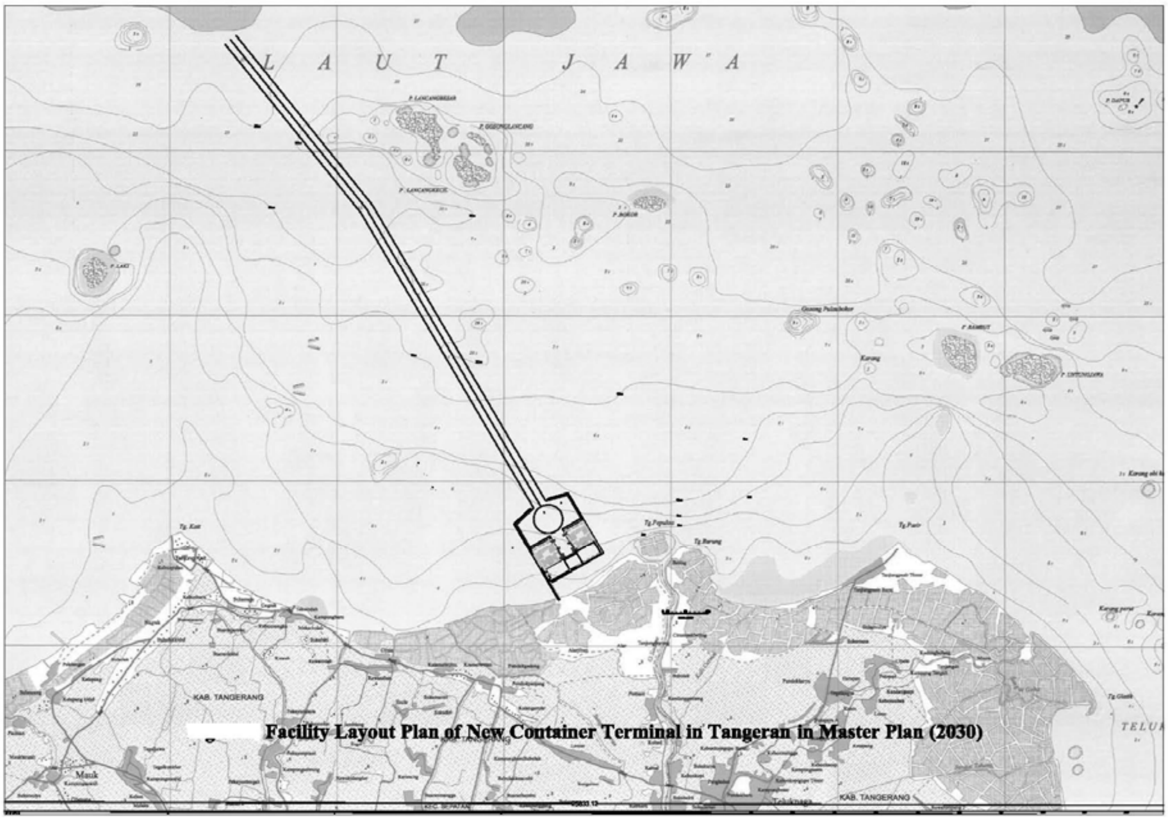
Shore line changes

A protruding shoreline change is seen in this coast around the river-mouth area of Ci Sadane (1940 ~ 1993: 500 ~ 1,050 m; 1993 ~ 2009: 480 ~900 m). The yearly rate of shoreline change is estimated as 10 ~ 20 m/year from 1940 ~ 1993 and 30 – 56 m/year from 1993 ~ 2009. The shoreline change is still bigger in recent years. The change width was 200 to 300 m in the 50 to 60-year period, and the yearly rate of shoreline change is estimated as 4 m/year.

2) Planning Criteria for Development of Channel/Basin.

Considering the local conditions of configuration of contour lines and existence of islands along this coast the access channel alignment is planned to reach the water depth more than 16 m depth without interference of the scattered small islands as shown in the Figure below.

To receive the design size of vessel the shallow parts less than 16m depth must be dredged to -15.5m.The distance to reach the sea bed depth of -16m from the coast is around 9-10 km. This distance of shallow parts of the planned access channel requires dredging to -15.5m CDL(MSL-16.0m).



Source: JICA Study Team

Figure 5.1.4-1 Facility Layout Plan of New Container Terminal in Tangerang (2030)

The entrance of the access channel is planned at the depth of -20m on the west side of the Lancang Islands area. The total length of the access channel is estimated around 11 km from the entrance of the new terminal.

Figure 5.1.4-1 shows the planned alignment of the access channel.

The basic space requirements and bending of the navigation channel and basin are determined in accordance with the international standards including PIANC. It suggests that the intersection angle of channel centre lines at a bend should not exceed approximately 30 degrees.

The expected maximum ship size to call the new terminal is set as Post-Panamax type. To receive this size of vessel the basic space requirements of the navigation channel and basin are determined as follows.

Table 5.1.4-1 Objective Ship Size for Planning Access Channel

Description	
Objective Container Ship Size	87,545DWT, D=14.0m, LOA=318m, B=40.06m
Depth and Width of Channel	D=15.5m, W=310m
Depth and Width of Turning Basin	D=15.5m, W=640m
Depth of Berth and Length	D=15.5m, W=360m

Source: JICA Study team

To allow two-way traffic of 87,000 GT vessels the new access navigation channel is set at 310 m in width and 15.5 m in depth. The channel width meets international standards and the water depth requirements are reasonable.

The alignment of the navigation channel is selected from the sea charts in which the sufficient space is indicated between the Lamcang Islands and Jawa Sea to plan the access channel alignment.

The turning circle is planned in the entrance area of the new terminal by taking the diameter of two times of LOA (640 m) and depth of -15.5m.

3) Proposed Scope of Channel Development

Dredging Requirements for Navigation Channel

The dredging requirement is estimated by superimposing the proposed channel/basin improvement plan on the bathymetric survey produced by the JICA Study Team. The water depth for dredging has been set at -15.5 m at the Channel and turning basin and side slope of the dredging section is assumed to be 1 to 5.

The net volume of dredging requirements for the long term plan is summarized in the Table below. The location of each area is shown in Figure 5.1.4-3.

It is advised to conduct the detailed bathymetric survey in the outer channel area to determine the exact location of the entrance and bending points of the planned channel and its depth and estimate dredging volume at the detailed design stage.

Table 5.1.4-2 Dredging Volume Requirement in Long Term Plan

Location	Design Depth	Dredging Volume (m3)
Access Channel	-15.5m	20,167,950
Harbor Turning Basin		
Outer Basin 1	-15.5m	9,711,824
Inner Basin 2	-15.5m	1,647,360
Inner Basin 3	-12.5m	929,280
Total Volume		32,456,414

Source: JICA Study Team

Construction of breakwater for the long term development plan

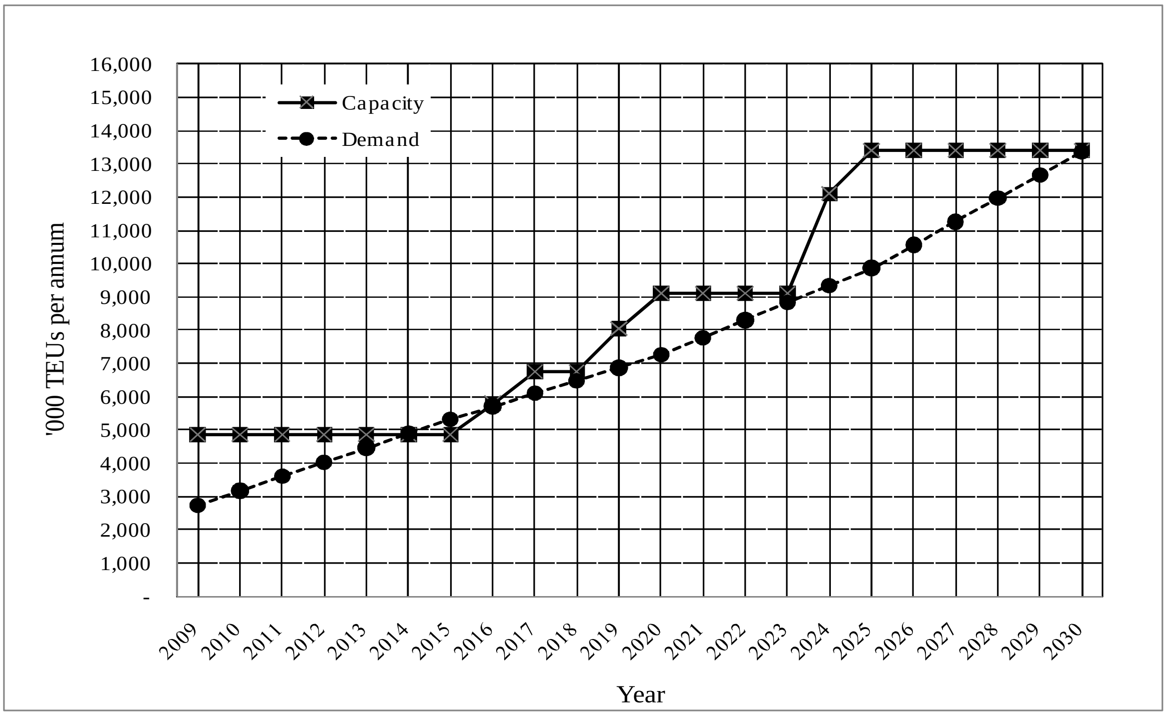
Figure 5.1.4-3 shows the long term development plan of the Tangerang new container terminal. The new terminal at Tangerang is planned to be developed in the off shore island. In order to protect the terminal facilities it is planned to be located about 420m away from the existing shore line.

The off shore terminal is protected by a new north west breakwater with a length of 510m and northeast breakwater with a length of 470m. The length of the west and east breakwater is 640 m x 2 = 1,280m. The detailed construction plan of the new breakwater is described in Chapter 5.1.1.

(2) Preliminary Design of Quay wall Development

1) Phased Development of New Terminal at Tangerang

The new container terminal at Tangerang is planned to be developed after the first, second and third phases of North Kalibaru terminal development is implemented, then the Tangerang terminal will be developed according to the progress of traffic demands expected by 2025 as shown in the following graph.



(Option 3: Tangerang with North Kalibaru)
Source: JICA Study Team

Figure 5.1.4-2 Phased Development of New Container Terminal

Required number of container berths at Tangerang is worked out in the following sequences, assuming that the new terminal development up to parts of phase 3 at North Kalibaru in Tanjung Priok will be carried out first to meet the traffic demands by 2025.

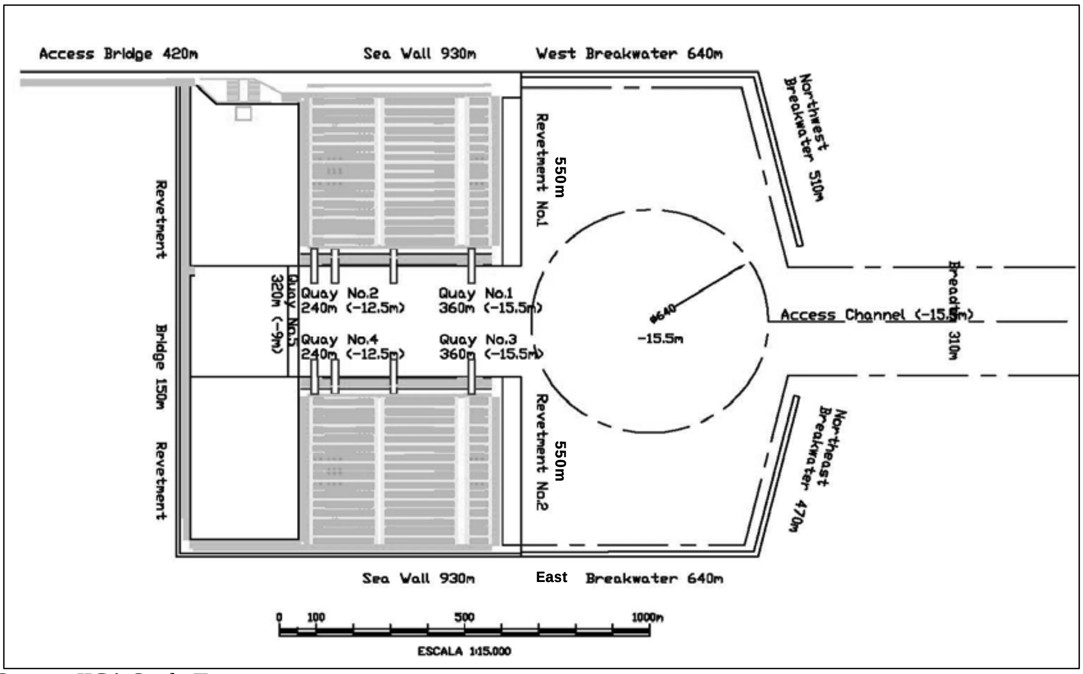
Table 5.1.4-3 Phased Development of Terminal Facilities at Tangerang

North Kalibaru Phase 1 (2014 - 2019)	**Target of Capacity: 1.9 million TEU**	
Container Terminal(Phase1)	Quay Length 1,200 m; Depth -15.5 m	1.9 million TEU
Breakwaters and Revetment construction, Channel and basin development by dredging are carried out, Access road and railway connection are carried out at North Kalibaru.		(Capacity Development: +1.9 million TEU)
North Kalibaru Phase 2 (2019 - 2025)	**Target of Capacity: 5.1 million TEU**	
Container Terminal (Phase 2):	Quay Length 2,000 m; Depth -15.5 m	Capacity Development: +3.2 million TEU
Tangerang with North Kalibaru (2025 - 2030)	**Target of Capacity: 9.4 million TEU**	
North Kalibaru Phase 3	Quay Length 1,200 m; Depth -15.5 m	Capacity Development: +2.3 million TEU
Tangerang	Capacity Development: +2.0 million TEU	
Quay No.1 (-15.5 m)	1 berth@360 m	0.7 million TEU
Quay No.2 (-12.5 m)	1 berth@240 m	0.3 million TEU
Quay No.3 (-15.5 m)	1 berth@360 m	0.7 million TEU
Quay No.4 (-12.5 m)	1 berth@240 m	0.3 million TEU
Quay No.5 (-9.0 m)	1 berth@320 m	Multi-purpose
Revetment construction works, Channel and Basin development by dredging and access road construction are carried out		

Source: JICA Study Team

2) Development Plan of Tangerang New Container Terminal

The development plan of new Tangerang terminal facilities is shown in the Figure 5.1.4-3.



Source: JICA Study Team

Figure 5.1.4-3 Long Term Development Plan of Tangerang Container Terminal

3) Code and Standards for Preliminary Design of Quay wall

The design criteria of marine and civil works conform to the same design standards and reference as applied for North Kalibaru new terminal development described in Chapter 5.1.2.

4) Design Criteria

The same design criteria of marine and civil works as described in Chapter 5.1.2 is applied and the supplement detail of design criteria as described in Section K, SERES is also applied, except the objective ship size, soil and wave conditions of construction site.

Objective ship size

It is assumed that the following two different sized container ships will use the new terminal. The dimensions of the container ships using the new terminal facilities at Tangerang site are summarized in Table 5.1.4-4.

Table 5.1.4-4 Objective Container Ship Size for planning Quay wall Structure

Type of Container Ship	Post-Panamax	Medium Size
Dead Weight Ton (DWT)	87,545	33,750
Loading Volume (TEU)	5,648	2,550
LOA (m)	318	207
Beam (m)	40.06	29.84
Draft (m)	14.0	11.4

Source: Containerization International

Tide and wave conditions at Tangerang

The tide level and wave conditions at Tangerang region are summarized in Table 5.1.4-5 for conducting preliminary design of terminal facilities.

Table 5.1.4-5 Tide, Current and Wave Conditions of Tangerang Site

	Tangerang site
Tide (cm)1	
High Water Level (HWL)	+108.00 CDL (MSL +59.0)
Mean Sea Level (MSL)	+59.00 DL(MSL +0.00)
Design Low Tide Level (DLT)	0.0 DL(MSL – 48.0)
Wave at Berth,	
Significant Wave Height H1/3(m)	0.50 m
Significant Wave Period T1/3	Less than 2 sec
Wave at Revetment	
Design Wave Height (m)	1.5 m
Design Wave Period (sec)	Around 6 sec
Wave at Breakwater	
Significant Wave Height H1/3 (m)	2.50m
Significant Wave Period T1/3	Around 9 sec

Source: JICA Study team by site observation record in 2010 May/June

Subsoil Condition

The location of bore holes of the soil investigation carried out by the JICA Study in 2010 and its soil profiles of Tangerang area is shown in Section K, SERES.

According to the geotechnical investigation of the candidate terminal development area at Tangerang, the following parameters shown in Table 5.1.4-6 as soil conditions are taken from section of BH.01 – BH.02, which is the exact location where the breakwater of off shore terminal is planned.

Table 5.1.4-6 Soil Profile for Preliminary Design

BH01 - BH02 Off shore of Tangerang Site		
Depth from Existing sea bed (0.8 ~-5.0m)	Elevation from DL 0.00	Soil Profile
- 4.5 m	-12.0m	Silty Clay to silty clay mixed with small parts of organic, very soft grey in color N= 0
- 8.0m	-16.5 m	Sandy silt mixed fragmentak shell to silty sand, hard to very dense condition consistency N= 13 ~18 , ϕ = 30°, γ' = 1.37 tf/m^3
-14.0 m	-22.5m	Silty clay to Sandy Clayer silt, stiff to very stiff, light grey N= 18 ~27, ϕ = 30°, γ' = 1.79 tf/m^3
-25.5 m	-34.0m	Silty Sandy mixed with small part of gravel, dense to very dense condition, N =20 ~>60, ϕ = 30°, γ' = 1.86 tf/m^3
-30.0 m	-39.5m	Sandy Clayer silt, hard consistency, dark grey in color N = more than 50 ϕ = 35°, γ' = 1.77 tf/m^3

Source: JICA Study Team

Crown Height of Quay wall

As a preliminary design of the container quay wall structure at Tangerang site, the crown height is set at the same level as at North Kalibaru and Cilamaya, namely, 3.5m from DL (+3.0m from MSL) considering the ship size and required efficiency of cargo handling operation.

5) Selection of Quay wall structures

Considering the similar site condition and soil conditions, same seismic coefficient zone, live loads of cranes, vehicles of the Tangerang sites, the same type of quay wall structures i.e. “Concrete Deck on Open Steel Pipe Pile type” as designed for North Kalibaru in Tanjung Priok is applied for the new terminal at Tangerang.

The corresponding dimensions of berthing facilities for the objective ship size are set as shown in Table 5.1.4-7:

Table 5.1.4-7 Berth Dimensions of Corresponding Ship Size

Type of Ship	Berth Dimension		Diameter of Turning Basin (m)
	Depth (m)	Length (m)	
Small Size	9.0	200	-
Medium Size (33,750DWT)	12.5	240	420
Post- Panamax (87,545DWT)	15.5	360	640

Source: JICA Study Team

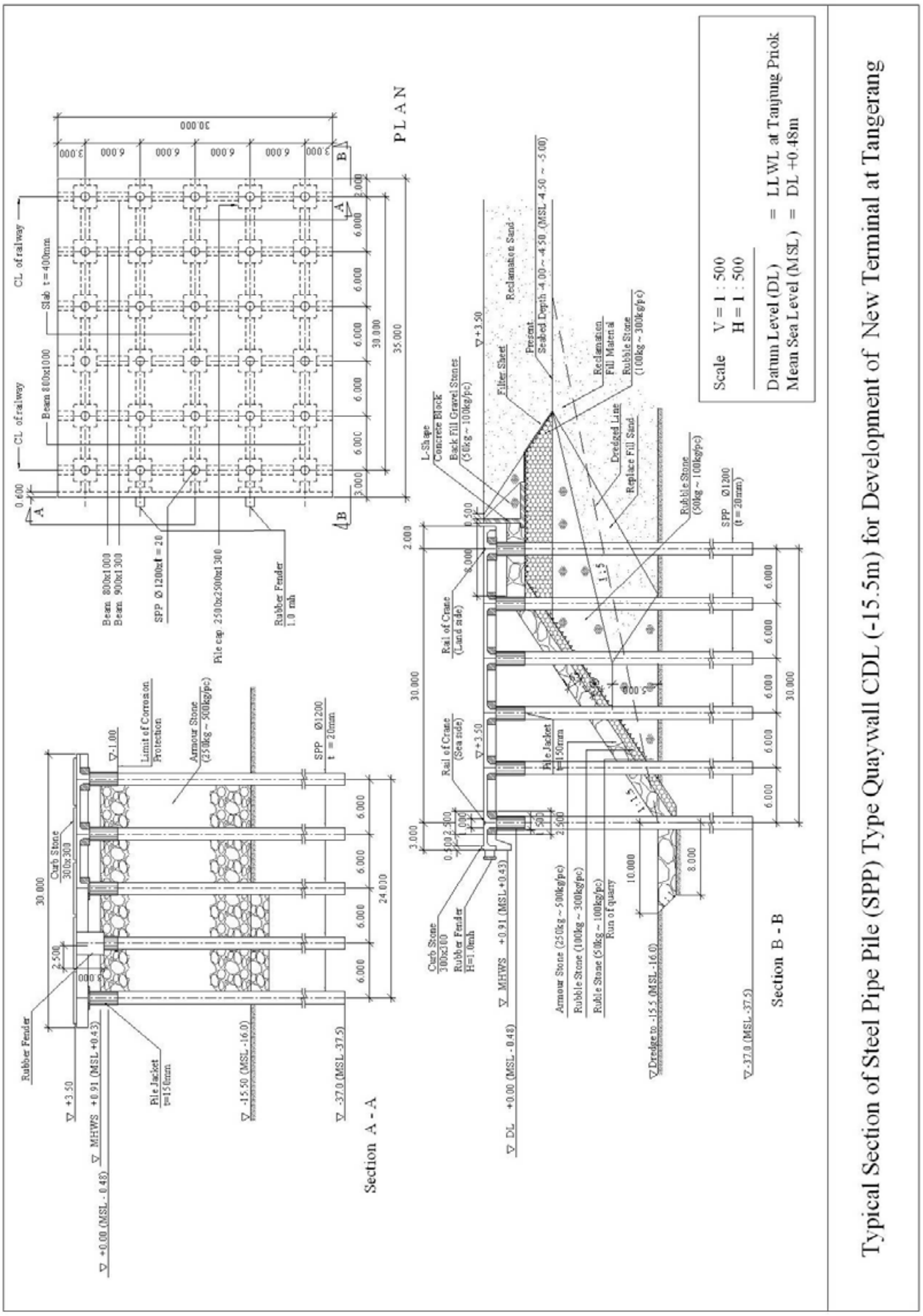
A medium-sized quay wall is designed considering the following elements.

The berthing reaction by ship of 33,750 DWT is about 120-130 tons.

- The water depth in front of the berth is set at -12.5m, shallower than Post panamax and
- The hard layer is encountered at the depth of around -30 m of the site soil condition.
- As a result of stability checking the foundation pile (SPP) size is reduced to Ø900mm, t=16mm from the case of Post Panamax and penetration length is estimated up to-37 m (MSL -37.5m)

The Quay wall for designed depth of -12.5m for medium size container ship is applied the same type and dimension of structures as adopted for the Cilamaya site.

The typical cross section of Quay wall structure for Medium size (-12.5m depth) is the same as used for the Cilamaya new terminal (see Figure 5.1.3-5). The cross section of Quay wall for Post-Panamax (-15.5m) at Tangerang new terminal is shown in Figure 5.1.4-4

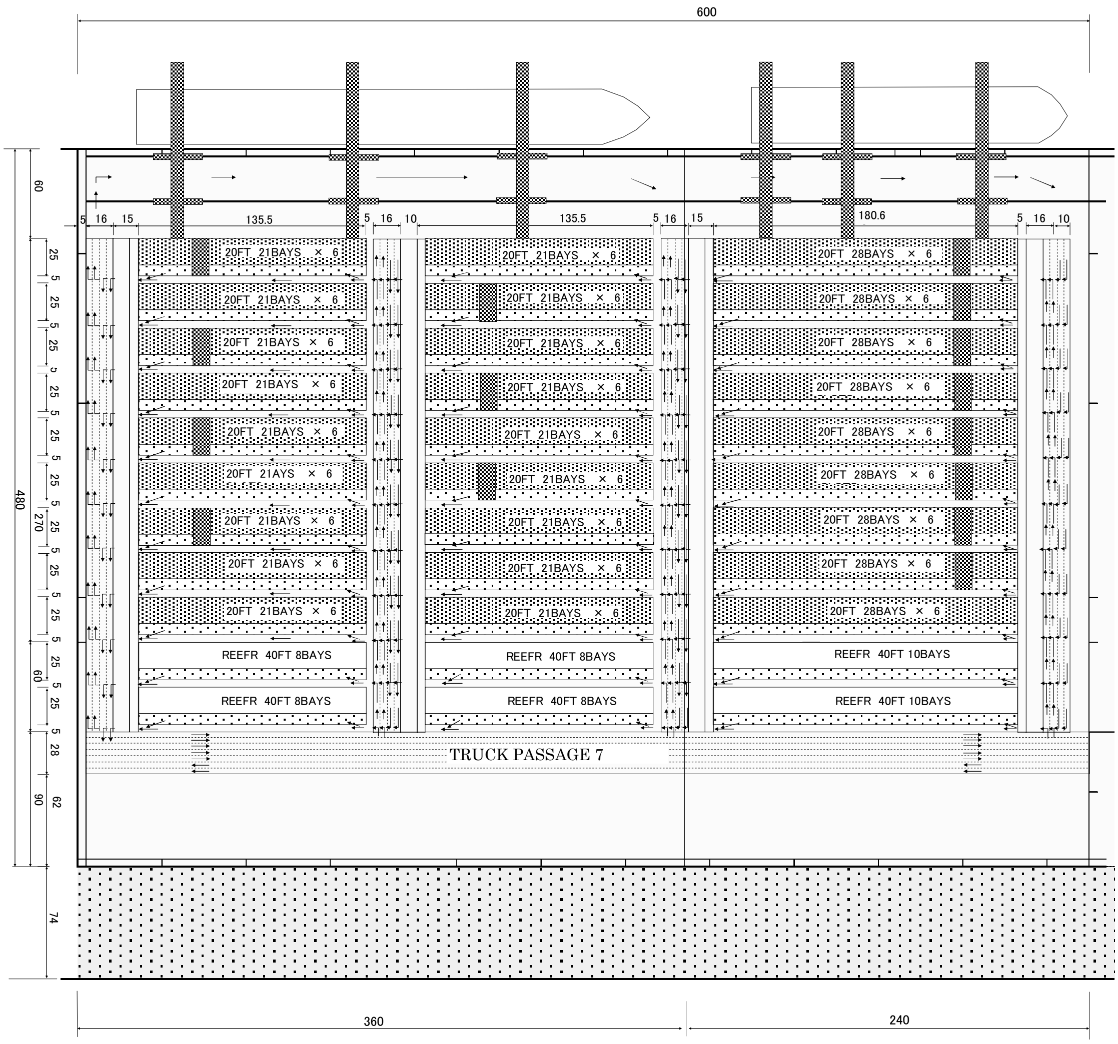


Source: JICA Study Team

Figure 5.1.4-4 Typical Section of Steel Pipe Pile (SPP) Type Quay wall (-15.5m) at Tangerang New Terminal

(3) Container Yard Planning

Planned layout of the Tangerang terminal is shown in Figure 5.1.4-5, and this layout of two berths is 360m and 240m, which involved building 1,520m total length of quays. The back up distance for container yard is 480m with the exception of the bank space.



Source: JICA Study Team

Figure 5.1.4-5 Container Yard Layout (360m and 240m)

Design condition of estimated required container handling equipment for 1 berth is shown in Table 5.1.4-8 and required quantity and type of cargo handling equipment are listed in Table 5.1.4-9.

Table 5.1.4-8 Design Condition of 1 berth (240m)

Capacity(TEUs/Year/berth)	560,000
Av. Days of Stock	3.3
Stacking Efficiency	0.75
Peak Ratio	1.3
Feeder Ratio	0.02
Yard Capacity(TEUs)	8,604
Tier	4
Calculated Ground Slots(TEUs)	2,151

Source: JICA Study Team

Table 5.1.4-9 Required Type and Quantity of Cargo Handling Equipment per1 terminal (600m)

CGC	6
Yard tractor	36
Yard chassis	38
RTG	15
Top Lifter	3
Forklift 5t	6
Forklift 10t	6

Source: JICA Study Team

Berth composition is worked out based on the terminal facilities as planned to meet the traffic demands and listed in Table 5.1.4-10. Based on the planned new terminal facilities, number of berths is 5, the total berth length is 1,520m, and water depth of berths is from 9.0m to 15.5m. Proposed container yard area, ground slots, required number and type of container handling equipment are worked out and listed in Table 5.1.4-11 based on the similar concept of estimating required cargo handling equipment at North Kalibaru terminal Phase 1 Project.

Table 5.1.4-10 Planned Berth Composition (Tangerang)

	Water depth (m)	Length (m)	Berth	Subtotal (m)
No.1,No.3	15.5	360	2	720
No2,No.4	12.5	240	2	480
No.5	9.0	320	1	320
Total (m)			5	1,520

Source: JICA Study Team

Proposed container yard and required cargo handling equipment of the new container terminal at Tangerang are worked out and listed in Table 5.1.4-11 based on the similar concept of the Phase 1 for estimating required cargo handling equipment at North kalibaru terminal.

Table 5.1.4-11 Proposed Type and Quantity of Container Handling Equipment (Tangerang)

Berth Length (m)	1,520
depth (m)	9.0〜15.5
Capacity(million TEUs)	2.0
Ground Slot(TEUs)	7,636
QGC No.	14
Yard tractor	84
Yard chassis	90
RTG	35
Top lifter	7
Forklift 5t	14
Forklift 10t	14

Source: JICA Study Team

(4) Yard Development by Reclamation

1) New Seawall for West and East sides of Reclamation

The yard for new terminals is planned to be developed by reclamation in the off shore island about 420m away from the existing coastal line. The length of the new sea wall is 930 m x 2 =1,860m and the revetment has a length of 1,320m on the south side of the off shore island for protecting the terminal service area, which will be constructed with rubble stones mound and armour stones thereon to absorb waves.

The soil condition of the foundation is soft clay and loose sand grey at the upper layer from the existing sea bed level to the depth of -4.5m.

Considering the soil conditions of the seawall/revetment foundation area, type of structure of the seawall/revetment is designed by Gravity Type (concrete blocks wall is placed on the stone mound from the sea bed depth of-4.0 to -4.5m).

The type of seawall/revetment structure for reclamation of Tangerang site is examined based on the actual experiences of JKT fishing port project carried in 1981, which is adopted for the design of the sea wall / revetment at North Kalibaru new terminal.

According to the development plan of the new container terminal, the seawall/revetment of both sides of the reclaimed land and terminal service area is designed as permanent structures. The seawall/revetment structure is designed with the same concept as adopted for the North Kalibaru.

The crown height of the seawall/revetment is set at +2.5 m from CDL considering designed wave height of 1.5 m, design wave period of 6 sec and dominating direction of North East.

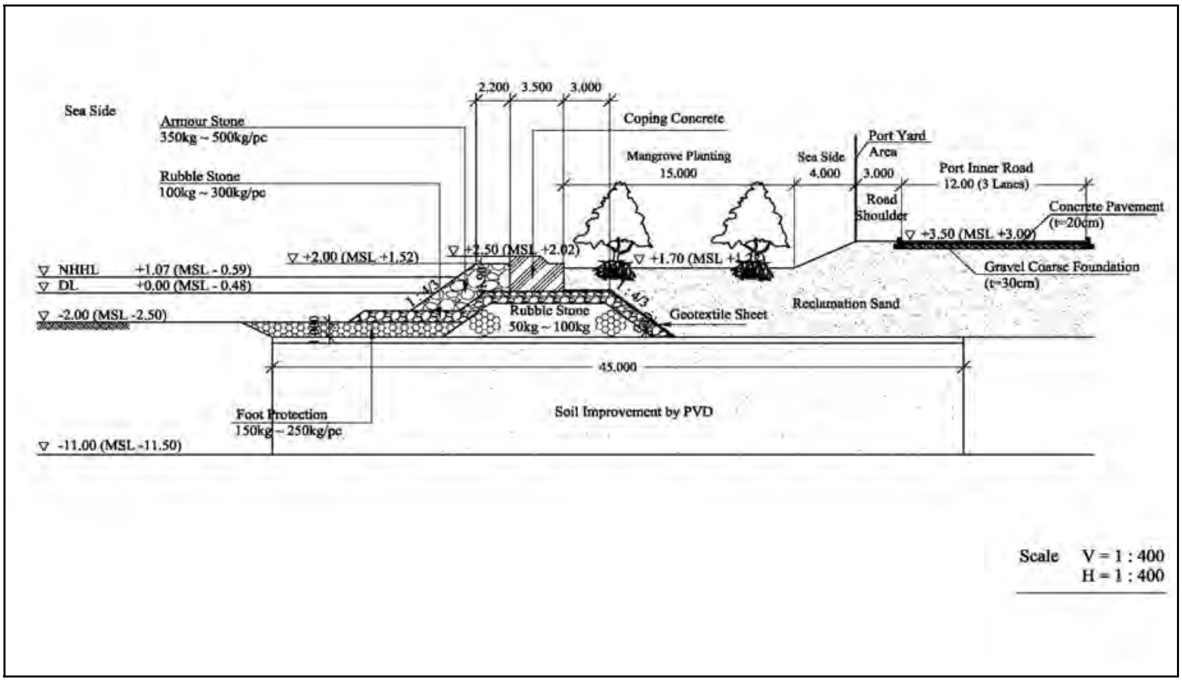
Both sides of the seawall and revetment on the south side are constructed with rubble mound with armour stones and concrete block to be placed on the top of the stone mound. The armour stone (500kg to 1.0 ton type) will be placed on the slope of the off-shore side of the seawall for wave–absorbing facilities and layer of rubble stones (250 to 500 kg) will be placed on the slope.

Behind the concrete block the reclamation sand is filled up to +1.50m (MST +1.00) and about 15 m away from concrete block the ground level is gradually increased to +3.50m (MST + 3.0m). The typical cross section of sea wall and breakwater of the west and east side is shown in Figure 5.1.4-6.

Mangrove planting is planned as a marine eco friendly arrangement between the seawall and reclamation yard. Mangroves protect terminal facilities from salty sea breeze.

It is recommended that the circular slide and failure of the seawall structure with PVD be carried out at detailed design stage based on the detailed soil data obtained by field investigation.

The revetment of south side of the off shore island will be constructed with similar type of structure as adopted for revetment works of Cilamaya new terminal which is described in 5.1.3 and typical section of structure is shown in Figure 5.1.2-14.



Source: JICA Study Team

Figure 5.1.4-6 Typical Cross Section of Sea wall of West/East sides at Tangerang Terminal

2) Reclamation works

Reclamation volume

The soil conditions from the seabed indicate that the dredged material for turning basin in the new terminal area is not suitable to use for the reclamation material. It is planned to obtain such reclamation material from outside of the new terminal site.

Reclamation works will be carried out by filling material such as quarry run and rubble stones taken from the quarry around the project sites. The in fill materials are transported by dump trucks from the existing quarry near the project site (possibly from Bojonegara area in Banten Province). The infill material should be filled from the existing sea bed around -4.0m up to +2.5 m from CDL.

Average thickness of reclamation will be 6 to 7 m. The estimated volume for respective phases is shown in the Table below. Average elevation of the planned yard after pavement will be +3.5 m (MST+3.0m). The reclamation volume by area at Tangerang new terminal is shown in Table 5.1.4-12.

Table 5.1.4-12 Reclamation Volume (m3) at Tangerang Yard Development

Area of Reclamation	Volume (m3)
Container Berths QW1 area (-15.5m)	1,555,200
Container Berths QW2 area (-12.5m)	3,220,000
Container Berths QW3 area (-15.5m)	1,555,200
Container Berths QW4 area (-12.5m)	3,220,000
Container Berths QW5 area (-9.0m)	556,800
Terminal Service Area	1,854,000
Total (m3)	11,961,200

Source: JICA Study team

Soil Improvement

The soil data obtained from the investigation indicates that there is soft clay soil upper layer from the existing sea bed to depth of 4 .0m. This soft layer up to -11.0m may be reinforced by adopting PVD as soil improvement works. The sandy stiff and hard layer around the depth of -12 to 14 m from the existing sea bed level will be encountered.

The soil improvement for the reclamation area shall be studied carefully based on results of detailed soil investigation.

The PVD Method at the foundation of stock yard, roads and building area may be considered applicable, since this method is one of the most practical methods of compaction for granular material, however specification of compaction and infill material shall be decided after practicing a series of experimental works.

(5) Yard Pavement and Drainage

Since the operation planning inside the container terminal at the Tangerang new terminal will be the same as North Kalibaru and Cilamaya, the pavement type for the usage of respective areas are selected according to the same type and quality as adopted for North Kalibaru. The drainage system will be planned together with the pavement works.

(6) Road for Terminal Development

1) Access Road Connection from the Toll way to the Terminal

The new access road connecting from the planned JORR2 route to the new terminal is required for operating the Tangerang new terminal. The off shore terminal which is planned about 420m away from the existing shore line is connected by a PC girder bridge from the shore. The detailed planning of alignment of the access road from the planned JORR 2 route and design of access road structure are described in Chapter 5.3 “Access Road Development”.

2) Terminal inner Road

The terminal related traffic from the hinterland enters and exits the terminal area through the exclusive gate of a new container terminal, which is planned at the eastern end of the terminal yard by a bridge connecting to off shore terminal.

The Tangerang new terminal is expected to handle about 2.0 mil TEU of containers by 2030. This means that about 2.0 mil truck chassis are required in 2030 annually to transport containers.

The inner road in the new terminal is planned to have 3 lanes (2 lanes for through traffic and 1 lane for gate queue) surrounding the reclaimed land outside the container yards.

The terminal inner road is planned to have 12 m width for 3 lanes and concrete pavement (t=20cm) with gravel coarse foundation (t=30cm) to sustain the standard truck’s (H22-44) wheel load of 8.0 ton/wheel.

The terminal inner road is planned to be constructed between the sea wall / revetment and the edge of container yards on the east side over a length of 1,480m (930 +550m) and on the west side over a length of 1,480m (930 +550m). The port inner road on the south side of the terminal service area will have a length of 1,420m.

(7) Utility supply and Buildings

1) Utility Supply

Water Supply

Water supply system will consist of water reservoir, pump house, elevated water tank and distribution system for general purpose of the office, ship, hydrant, and fire fighting inside of the terminal area. The water supply to the vessels, fire fighting and buildings are provided. The water supply pits and pipeline along the berth will be provided to supply water to ships.

The same water demand as planned for North Kalibaru terminal Phase 1 will be required for Tangerang new terminal.

The outdoor-hydrant boxes are installed in the Maintenance Shop and CFS. The indoor-hydrant boxes are provided for the other buildings. The water pipes in the terminal area will be connected with the terminal water reservoir.

It is assumed that the water source should be arranged from the main supply line of the public water of the Water Supply Works Department of the Tangerang Regency.

Minimum pressure at the farthest supply point should be 50 psi for the domestic demand and ship supply, while much higher pressure of 65 psi should be provided for the fire fighting.

Power Supply

The same electric power demands for new container terminals as planned for the North Kalibaru Phase 1 will be required for Tangerang new terminal since this the number of Quay cranes is the same.

It is assumed that the electric power requirement of the new terminal at Tangerang will be supplied from the regional power supply station of National Electric Cooperation (PLN). A standby generator set for emergency purposes will be installed.

Environmental Treatment Facilities

The following environmental treatment facilities as planned for the North Kalibaru will be provided for the new container terminal at Tangerang.

- Drainage/sewerage outfall facilities
- Solid wastes management facilities
- Ballast and Bilge Waste Treatment System

2) Building works

All the buildings inside the new terminal will be designed in conformity with relevant national codes and standards, such as National Structural Code for Buildings, National Plumbing Code of the Indonesia, Indonesia Electrical Code, Fire Code of the Indonesia, etc.

The same size of floor area for each building as provided for North Kalibaru phase 1 is planned for the new container terminal at Tangerang.

Security System

The security system facilities as provided for North Kalibaru new terminal is planned for the new terminal at Tangerang to comply with SOLAS amendments and ISPS Code in order to function as an international container terminal.

The cargo container X-ray inspection system, CCTV system, gate control and fences are considered to meet the requirements of SOLAS and ISPS code. These facilities should be provided in the gate area junction with off shore access bridge from the JORR 2 at the east end of the terminal area.

5.1.5 Implementation Schedule of Master Plan

Considering the urgency of each project component and step-by-step development, and in line with the development scenarios composed of the phased development of the container terminals at

North Kalibaru, Cilamaya and Tangerang as well, the Study Team examines the implementation schedule for proposed major projects as shown in the following diagrams, Figure 5.1.5-1, Figure 5.1.5-2 and Figure 5.1.5-3. Implementation schedule is made taking into consideration the time of the administration procedures and in accordance with construction capability.

(1) Development Scenario 1 (North Kalibaru)

The first development scenario consists of three phased container terminal development fully concentrated at offshore Tanjung Priok Port (North Kalibaru). Development Scenario 1 (North Kalibaru) is presented in Figure 5.1.5-1.

1) Phase I

Planned extension of quay wall in the development of North Kalibaru Phase I amounts to 1,200 m; the construction period for the total extension of the quay wall is estimated as roughly 34 months at least assuming the size of unit block of RC slab (30 m x 35 m) supported by 30 steel pipe piles. Concrete works (around 500 m^3 per block) and curing of concrete as well will be critical for the work period.

The planned dredging volume to deepen the channel and harbor basins up to -15.5 m in the development of North Kalibaru Phase I amounts to 16 million m3 (including overdredging). Assuming the use of cutter suction dredger and considering busy port operation and ship traffic in the port area of Tanjung Priok, the work period is estimated as roughly 40 months at least by deploying three (3) fleets of dredging vessels.

In order to materialize the planned container terminal operational in the 5th year after L/A (4th year after implementation of construction), the staged development of the container terminal Phase I should be taken into consideration.

Phase I development of the North Kalibaru Container Terminal is targeting container throughput of 1.9 million TEU/year as the capacity (quay wall length: 1,200 m), and the construction process of the terminal is divided into two stages along the length of quay wall (600 m + 600 m). The construction works managed in each stage are assumed as follows.

Stage 1 (2nd – 4th Year)

Dredging of channel and basins, demolition of the existing breakwaters, re-construction of breakwaters, construction of protective facilities (seawalls, revetments), quay wall of 600 m, reclamation and development of container terminal yard.

Stage 2 (4th – 5th Year)

Quay wall of 600 m, reclamation and development of container terminal yard.

Implementation schedule of the staged development of North Kalibaru Phase I is presented in Table 5.1.5-1.

2) Phase II

Construction works of Phase II development of North Kalibaru consist of (i) demolition of the existing breakwater (Dam Barat) sheltering the western entrance of Tanjung Priok Port, (ii) additional dredging of the basin (around 4.3 million m^3) in front of Phase II terminal, (iii) reclamation and development of Container Terminal Phase II (129 ha).

Four-year period is estimated for construction works of North Kalibaru Phase II development. Implementation schedule of North Kalibaru Phase II is presented in Table 5.1.5-1. The first 2 berths (quay wall: 600 m) will be enabled in the 4th year of construction in line with the requirement of demand forecast of container throughput.

3) Phase III

Construction works of Phase III development of North Kalibaru consist of (i) extension of the breakwater (2,637 m) to shelter the channel and basin in front of Phase III terminal, (ii) dredging of the channel and basin (around 17.6 million m^3) in front of Phase III terminal, (iii) reclamation and development of Container Terminal Phase III (190 ha).

Five-year period is estimated for construction works of North Kalibaru Phase III development. Implementation schedule of North Kalibaru Phase III is presented in Table 5.1.5-1.

The first terminal (2 berths@350 m; quay wall length 700 m) will be enabled to start operation in the 4th year of construction in line with the requirement of demand forecast. Terminal 2 (3 berths@300; quay wall 900 m) and Terminal 3 (2berths@350 m and 1 berth@300 m; quay wall 1,000 m) will be enabled to start operation in the 5th and 6th year after implementation of the construction.

(2) Development Scenario 2 (North Kalibaru and Cilamaya)

The second development scenario is the combination of the 1st phase development of container terminal at North Kalibaru and development of container terminals (1st and 2nd phases) at the Cilamaya site, West Java Province. Development Scenario 2 (North Kalibaru and Cilamaya) is presented its implementation schedule in Table 5.1.5-2.

1) North Kalibaru Phase I

This stage of development is common with the development scenario 1. Stage 1 and Stage 2 development (total 1.9 million TEU) will be implemented for the period of 5 years.

Following stages of development of container terminals are to be executed at the Cilamaya site.

2) Cilamaya Phase I

Construction works of Phase I development of Cilamaya container terminal will start with (i) construction of port access road (29.9 km) to connect the Cilamaya site with Cikampek Toll Road. The early stage of the port access road will be used as temporary road for transportation of labours, materials and equipment of construction works.

(ii) Construction of the Protective facilities will start with;

Breakwaters:	Northwest 726 m,	West 356 m
	Northeast 684 m,	East 356 m
Seawalls:	West 2,340 m,	East 2,340 m

followed by (iii) Dredging of the channel and basin (around 28 million m^3) to the design depth MSL-16 m, and (iv) Reclamation and development of Container Terminal Phase I (80 ha).

Quay No.1:	2 berths@360 m (MSL-16 m),	1.4 million TEU
Quay No.2:	4 berths@240 m (MSL-13 m),	1.4 million TEU
Quay No.3:	2 berths@240 m (MSL-16 m),	0.7 million TEU

The development target of Cilamaya Phase I amounts to 3.5 million TEU/year of container throughput. Four-year period is estimated for construction works of Cilamaya Phase I development. Implementation schedule of Cilamaya Phase I is presented in Table 5.1.5-2.

Quays No.1 and No.3 will be enabled to start operation in the 4th year after construction in line with the requirement of demand forecast. Quay No.2 will start operation in the 5th year after construction.

3) Cilamaya Phase II

Construction works of Cilamaya Phase II development consist of (i) reclamation and development of Container Terminal Phase III (190 ha), and (ii) development of Multi-purpose berth and Terminal Service area.

Quay No.4:	2 berths@360 m (MSL-16 m),	1.4 million TEU
Quay No.5:	4 berths@240 m (MSL-13 m),	1.4 million TEU
Quay No.6:	2 berths@240 m (MSL-16 m),	0.7 million TEU
Quay No.7:	3 berths@200 m (MSL-9.5 m),	0.5 million TEU

The development target of Cilamaya Phase I amounts to 4 million TEU/year of container throughput. Three-year period is estimated for construction works of Cilamaya Phase II development. Implementation schedule of Cilamaya Phase II is presented in Table 5.1.5-2.

Quays No.4 and No.6 will commence operation in the 3rd year after implementation of construction in line with the requirement of demand forecast. Quay No.5 will start operation in the 4th year after construction.

(3) Development Scenario 3 (North Kalibaru and Tangerang)

The third development scenario is the combination of the 1st through 3rd phases of development of container terminal at North Kalibaru and the development of container terminal at the Tangerang site, Banten Province. Implementation schedule of development Scenario 3 (North Kalibaru and Tangerang) is presented in Table 5.1.5-3.

1) North Kalibaru Phase I - III

Phase I development (total 1.9 million TEU) and Phase II development (total 3.2 million TEU) of North Kalibaru will be implemented together with development Scenario 1. The target volume of North Kalibaru Phase III is combined (reduced development target to 2.3 million TEU/year) with the development at Tangerang in this case.

2) Tangerang New Terminal

Construction works of Tangerang container terminal will start with (i) construction of the new terminal access road (4.9 km) to connect the Tangerang site with JORR2 at Teluknaga. Initially, the terminal access road will be used as temporary road for transportation and construction works.

(ii) Construction of the protective facilities will start with;

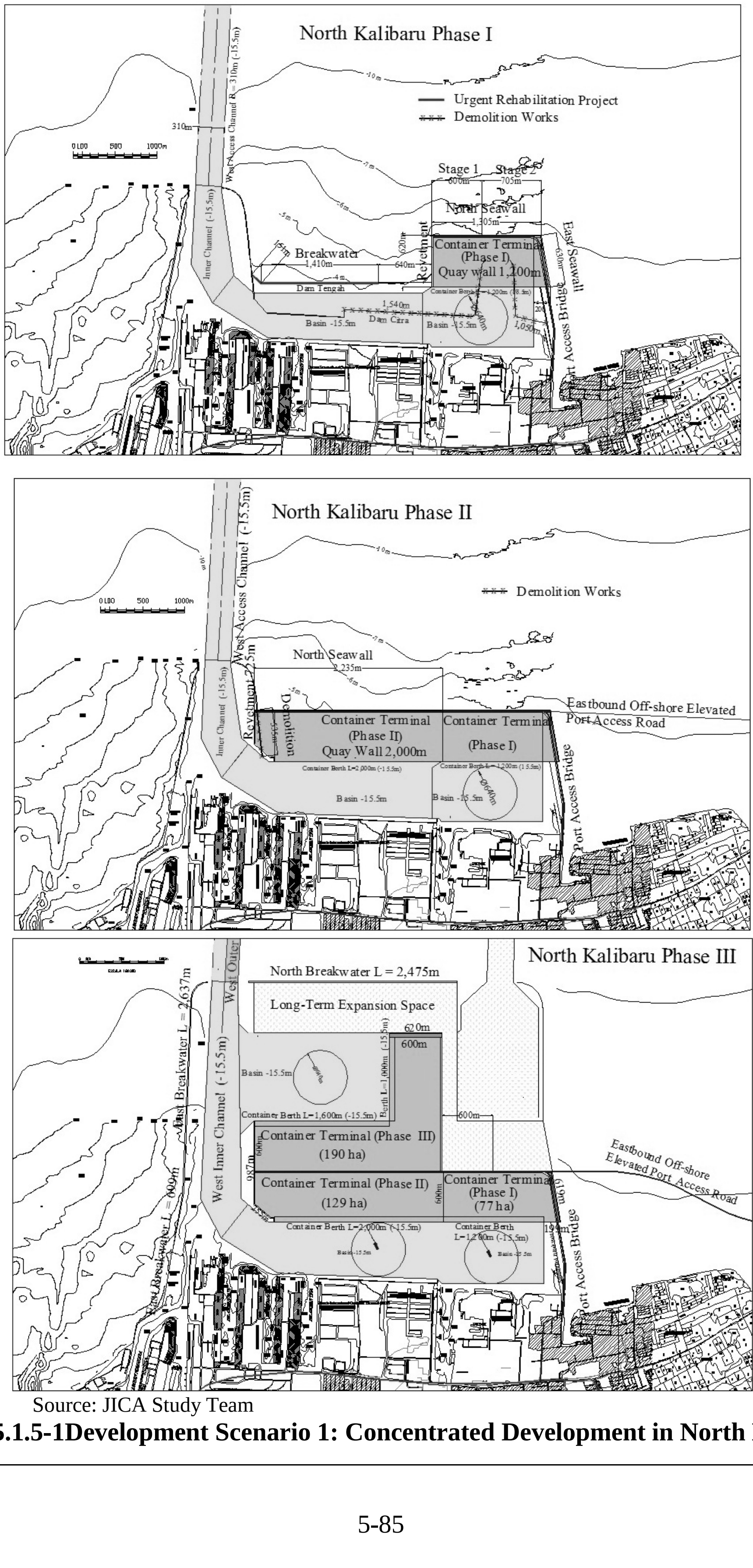
Breakwaters:	Northwest 510 m,	West 640 m
	Northeast 470 m,	East 640 m
Seawalls:	West 930 m,	East 930 m

This will be followed by (iii) Dredging of the channel and basin (around 32 million m^3) to the design depth MSL-16 m, and (iv) Reclamation and development of Container Terminals (58 ha).

Quay No.1:	1 berth@360 m (MSL-16 m),	0.7 million TEU
Quay No.2:	1 berth@240 m (MSL-13 m),	0.3 million TEU
Quay No.3:	1 berth@360 m (MSL-16 m),	0.7 million TEU
Quay No.4:	1 berth@240 m (MSL-13 m),	0.3 million TEU
Quay No.5:	1 berth@320 m (MSL-9.5 m),	Multi-purpose

The development target of Tangerang container terminal amounts to 2.0 million TEU/year of container throughput. Four-year period is estimated for construction. Implementation schedule of Development Scenario 3 is presented in Table 5.1.5-3.

Quays No.1 and No.2 will start operation in the 4th year after construction in line with the requirement of the demand forecast. Quays No.3 and No.4 will start operation in the 5th year after construction.



Source: JICA Study Team

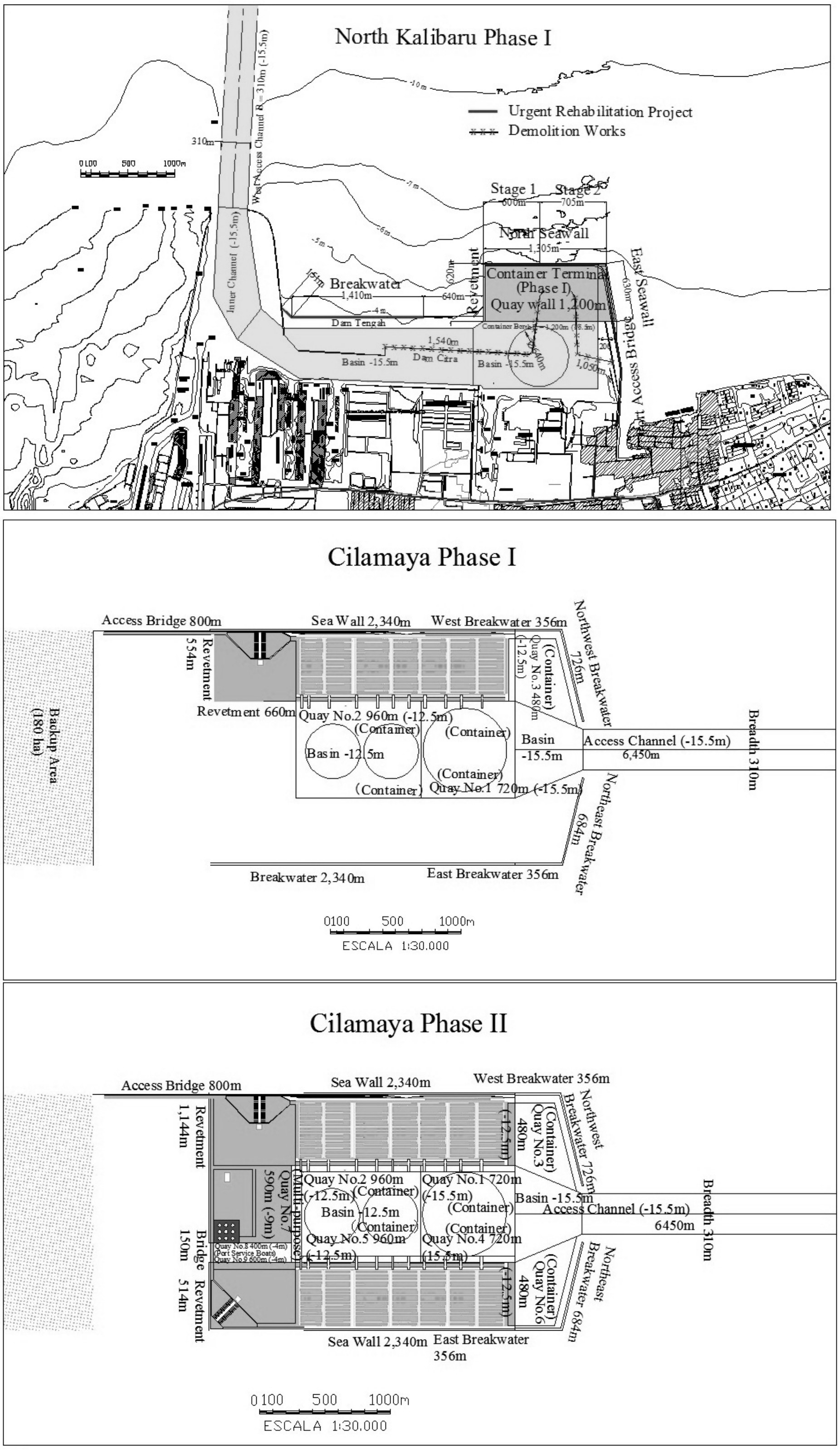
Figure 5.1.5-1Development Scenario 1: Concentrated Development in North Kalibaru

Table 5.1.5-1 Implementation Schedule of Development Scenario 1 (North Kalibaru)

Description	Ist Year After L/A	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
North Kalibaru Phase I							
1. Administration Procedure	///						
2. Construction Stage							
2.1 Access Road and Bridge		///	///				
2.2 Stage 1 of Container Terminal							
Breakwaters and Seawalls		///	///				
Dredging of Channel and Basin		///	///	///			
Container Terminal Stage 1		///	///				
Terminal Buildings				///			
Container Handling Equipment				///			
Security and Utility			///	///			
Start of Terminal Operation Stage 1					///	///	///
2.3 Stage 2 of Container Terminal							
Container Terminal Stage 2				///	///		
Terminal Buildings					///		
Container Handling Equipment					///		
Utility Facilities					///		
Start of Terminal Operation Stage 2						///	///

Description	2015	2016	2017	2018	2019	2020	2021
North Kalibaru Phase II							
1. Administration Procedure	///						
2. Construction Stage							
2.1 Offshore Road and Bridge; 11.6 km		///	///	///	///		
2.2 Container Terminal							
Demolition of Dam Barat		///					
Seawalls and Revetment		///	///	///			
Dredging of Channel and Basin		///	///				
Quay Wall Construction (2,000 m)		///	///	///			
Container Terminal II-1 (2 berth@300 m)				///	///		
Container Handling Equipment				///	///		
Start of Terminal Operation Tereminal 1					///	///	///
Container Terminal II-2 (2 x 2 berths @350 m)				///	///		
Container Handling Equipment				///	///		
Security and Utility				///	///		
Start of Terminal Operation Tereminal 2						///	///

Description	2020	2021	2022	2023	2024	2025	2026
North Kalibaru Phase III							
1. Administration Procedure	///						
2. Construction Stage							
Breakwaters							
Construction		///	///	///			
Demolition of Dam Barat				///			
Seawalls and Revetment			///	///	///		
Dredging of Channel and Basin		///	///	///			
Quay Wall Construction (2,600 m)			///	///	///	///	
Reclamation of Container Yard			///	///			
Container Terminal III-1 (2 berth@350 m)				///	///		
Container Handling Equipment				///	///		
Start of Operation Tereminal III-1					///	///	///
Container Terminal III-2 (3 berth@300 m)				///	///		
Container Handling Equipment					///		
Start of Operation Tereminal III-2						///	///
Container Terminal III-3 (2 berth@350 m + 1berth@300 m)					///	///	
Container Handling Equipment					///	///	
Start of Operation Tereminal III-3							///



Source: JICA Study Team

Figure 5.1.5-2 Development Scenario 2: North Kalibaru and Cilamaya I and II

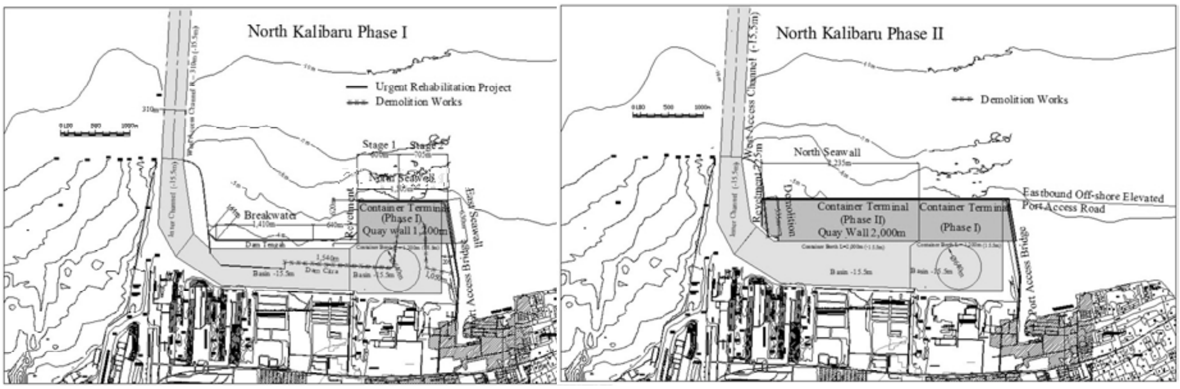
Table 5.1.5-2 Implementation Schedule of Development Scenario 2 (Cilamaya)

Description	Ist Year After L/A	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
North Kalibaru Phase I							
1. Administration Procedure	■■■■						
2. Construction Stage							
2.1 Access Road and Bridge		■■■■	■■□□				
2.2 Stage 1 of Container Terminal							
Breakwaters and Seawalls		□■■■	■□□□				
Dredging of Channel and Basin		□■■■	■■■■	■■■■			
Container Terminal Stage 1		□□■■	■■■■				
Terminal Buildings				■■■■			
Container Handling Equipment				■■■■			
Security and Utility			□□■■	■■■■			
Start of Terminal Operation Stage 1					■■■■	■■■■	■■■■
2.3 Stage 2 of Container Terminal							
Container Terminal Stage 2				■■■■	■■□□		
Terminal Buildings					■■■■		
Container Handling Equipment					■■■■		
Utility Facilities					■■■■		
Start of Terminal Operation Stage 2						■■■■	■■■■

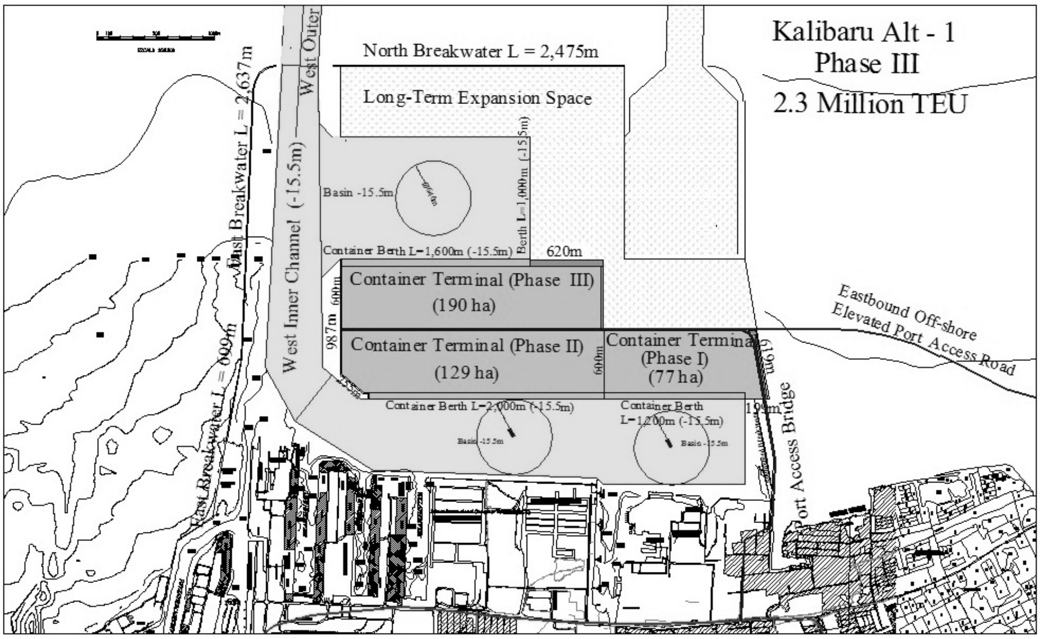
Description	2015	2016	2017	2018	2019	2020	2021
Cilamaya Phase I							
1. Administration Procedure	■■■■						
2. Construction Stage							
2.1 Access Road and Bridge		■■■■	■■■■	■■■■			
2.2 Container Terminal							
Breakwaters		■■■■	■■□□				
Seawalls and Revetment		□□□■	■■■■	■■□□			
Dredging of Channel and Basin		□□■■	■■■■	■■■■			
Berth No.1; Quay Wall and Reclamation			■■■■	■■□□			
Yard Pavement and Buliding				■■■■			
Container Handling Equipment				■■■■			
Start of Terminal Operation Berth No.1					■■■■	■■■■	■■■■
Berth No.2; Quay Wall and Reclamation				■■■■	■■□□		
Yard Pavement and Buliding					■■■■		
Container Handling Equipment					■■■■		
Start of Terminal Operation Berth No.2						■■■■	■■■■
Quay No.3			■■■■				
Terminal Service Area; Reclamation			■■■■	■■■■			
Container Handling Equipment			□□■■	■■■■			

Description	2021	2022	2023	2024	2025	2026	2027
Cilamaya Phase II							
1. Administration Procedure	■■■■						
2. Construction Stage							
Berth No.4; Quay Wall and Reclamation		■■■■	■■□□				
Yard Pavement and Buliding			■■■■				
Container Handling Equipment			■■■■				
Start of Terminal Operation Berth No.4				■■■■	■■■■	■■■■	■■■■
Berth No.5; Quay Wall and Reclamation			■■■■	■■□□			
Yard Pavement and Buliding				■■■■			
Container Handling Equipment				■■■■			
Start of Terminal Operation Berth No.5					■■■■	■■■■	■■■■
Quay No.6		■■■■					
Multi-purpose Berth; Reclamation			■■■■				
Yard Pavement and Buliding				■■■■			
Start of Terminal Operation Multi-purpose					■■■■	■■■■	■■■■
Terminal Service Area; Reclamation			■■■■				
Yard Pavement and Buliding			■■■■				
Security and Utility			■■■■	■■■■			

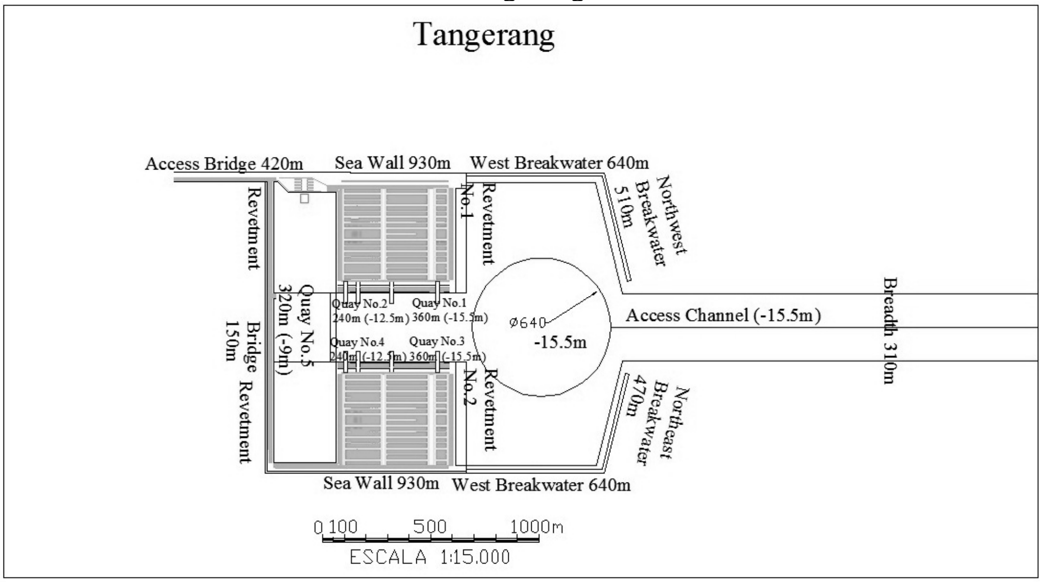
North Kalibaru Phase I and II



North Kalibaru Phase III (2.3 million TEU)



Tangerang



Source: JICA Study Team

Figure 5.1.5-3 Development Scenario 3: North Kalibaru I, II and III with Tangerang

Table 5.1.5-3 Implementation Schedule of Development Scenario 3 (Tangerang)

Description	Ist Year After L/A	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
North Kalibaru Phase I							
1. Administration Procedure							
2. Construction Stage							
2.1 Access Road and Bridge							
2.2 Stage 1 of Container Terminal							
Breakwaters and Seawalls							
Dredging of Channel and Basin							
Container Terminal Stage 1							
Terminal Buildings							
Container Handling Equipment							
Security and Utility							
Start of Terminal Operation Stage 1							
2.3 Stage 2 of Container Terminal							
Container Terminal Stage 2							
Terminal Buildings							
Container Handling Equipment							
Start of Terminal Operation Stage 2							
Utility Facilities							

Description	2015	2016	2017	2018	2019	2020	2021
North Kalibaru Phase II							
1. Administration Procedure							
2. Construction Stage							
2.1 Offshore Road and Bridge; 11.6 km							
2.2 Container Terminal							
Demolition of Dam Barat							
Seawalls and Revetment							
Dredging of Channel and Basin							
Quay Wall Construction (2,000 m)							
Container Terminal II-1 (2 berth@300 m)							
Container Handling Equipment							
Start of Operation Tereminal II-1							
Container Terminal II-2 (2 x 2 berths @350 m)							
Container Handling Equipment							
Start of Operation Tereminal II-2							
Security and Utility							

Description	2020	2021	2022	2023	2024	2025	2026
North Kalibaru Phase III (2.3 million TEU)							
1. Administration Procedure							
2. Construction Stage							
Breakwaters							
Construction							
Demolition of Dam Barat							
Seawalls and Revetment							
Dredging of Channel and Basin							
Quay Wall Construction (1,600 m)							
Reclamation of Container Yard							
Container Terminal III-1 (2 berth@350 m)							
Start of Operation Tereminal III-1							
Container Terminal III-2 (3 berth@300 m)							
Start of Operation Tereminal III-2							

Description	2020	2021	2022	2023	2024	2025	2026
Tangerang							
3. Construction Stage							
3.1 Access Road and Bridge							
3.2 Container Terminal							
Breakwaters							
Seawalls and Revetment							
Dredging of Channel and Basin							
Berth No.1 and No.2; 600 m							
Container Handling Equipment							
Start of West Terminal Operation							
Berth No.3 and No.4; 600 m							
Container Handling Equipment							
Start of East Terminal Operation							
Security Facilities							
Seervice Area and Utility Facilities							